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ANIMISTIC THINKING IN CHILDREN

by

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Department of Psychology
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Date: June 13, 1966

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James L. M. M.

A dissertation submitted in partial fulfillment
of the requirements for the degree of Doctor
of Philosophy in the Department of
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of Duke University

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ABSTRACT

(Psychology-Developmental)

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ABSTRACT

Animistic Thinking in Children

The objectives of the study were based on constructs which were originally described and studied by Piaget and some of which were studied subsequently by other authors with contradictory results. The four major objectives of the study were:

1. to reexamine the development of children's concepts of life, and, in particular to systematically investigate the relationship between children's errors in classifying items as alive or not alive and their use of different justifications for those classifications.
2. to attempt to elicit precausal explanations from children in response to demonstration items (Piaget originally studied precausality in terms of natural objects and events and subsequent experimenters failed to find the precausal forms for demonstrations).
3. to test the hypothesis that children who give pre-causal explanations will have difficulty in learning a causal relationship, even in the face of repeated experience.
4. to test the hypothesis that children who classify inanimate objects as alive (and are hence, animistic) will be the children who also give the greatest number of precausal explanations for demonstrations.
5. to attempt to relate systematic animism and pre-causality to a standardized measure of cognitive development.

In order to study these constructs and the relationships between them, 96 children between the ages of four and ten years, were individually administered a test battery consisting of (1)

an animistic questionnaire, consisting of 21 plant, object, and animal items to be classified as alive or not alive; (2) eight demonstrations about which the children were questioned in order to obtain their explanations for what took place; (3) a causal learning task, requiring the children to isolate a particular cause for the outcome of an event, given a number of trials and some directly relevant, extra experience and (4) the Peabody Picture Vocabulary Test.

The major findings were:

1. that reduction of animism in children is associated with the identification of life with animals and their characteristics. This association leads children to classify plants as well as objects as not alive, since plants have none of the more obvious characteristics of animals (locomotion, sensation, vocalization), and, it is only at some later stage, when life is identified with more general characteristics (need for air, water, food; death, birth, reproduction), that plants are again classified as alive.
2. Young children do indeed give precausal, non-mechanical explanations for demonstrations. The study suggests that Piaget's particular categories of precausal thought may not have universal validity for all kinds of events or for all children, but that the general characteristics of these explanations which he described (lack of attention to details of how things happen, lack of understanding of temporal sequences of events, and the lack of understanding of the need for spatial contact for the transfer of energy and motion) are found in the explanations of many young children, even for demonstration and mechanical events.
3. Children who gave precausal explanations for the causal learning task did fail to learn the correct cause-effect relationship.
4. There was no support for Piaget's theory that animism, or the attribution of life to objects, has a direct relationship to precausal explanations. In the present study, animistic children were not more likely to use precausal explanations than were non-animistic children.

5. Systematic animism and precausality were both related to scores obtained from the Peabody Test.

ACKNOWLEDGEMENTS

I wish to express my special thanks to Dr. Lloyd J. Borstelmann who has guided all my efforts in producing this dissertation; Miss Hinman, Director of the Duke University Pre-school, Mrs. Barbee, Director of the Greystone Baptist Church Nursery School, Mr. Whichard, principal of North Durham School, and Mr. Warehime, principal of Moorehead School, all of whom were most cooperative in providing subjects for the study from their schools; Miss Frances Cohen, Miss Gail Gerity, Mr. Tom Hammock, and Mr. Hugo Keesing, Duke University students who served as raters of the children's responses; and Miss Barbara Cohen, of the Institute for Developmental Studies who also rated some of the responses.

I also wish to express my indebtedness to Robert E. Barnes who originally encouraged me to enter graduate school; to my family and my wife's family who have contributed so much in terms of both financial and moral support; to my wife, Sherry, who lived through the entire production and who, alone, can fully understand what it represents.

Finally, I would like to dedicate this dissertation to my son, Harry, as a representative of all the small children whose cooperation made the study a possibility.

H.W.S.

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ANIMISTIC THINKING IN CHILDREN

Chapter I

INTRODUCTION TO THE PROBLEM

The work to be reported in this paper is in the tradition of empirical investigations and theoretical discussions originated by Piaget. In his efforts to systematically study and explain the development of the thought of the young child (Piaget, J., 1926, 1928, 1929, and 1930) one of his major findings concerns the animistic nature of children's thought processes. That is, he found that young children attribute life to inanimate objects and that they give inadequate causal explanations due to their inability to distinguish between mechanical and animate movement. Piaget contends that because the child cannot distinguish between points of view, he cannot view the world as separate from himself, and, because he cannot distinguish between psychic and physical reality, he operates as if the world were filled with will and intention similar to his own. In other words, when the child sees movement in the world or when he finds resistance to his own movement, he is stimulated to provide an explanation for it, and that explanation usually takes a motivational form.

It is this animistic precausality, then, this tendency

to explain events in terms of motivation, which for Piaget constitutes the original nature of animism in the child. Piaget also calls this original animistic tendency diffuse animism, and distinguishes it from what he calls systematic animism. The latter refers to the developmental history of the child's formal concept of life as he progresses from attributing life to many inanimate objects to the point where he restricts life to animals and/or plants.

What Piaget suggests is that the very youngest children, even before they have any formal concept of life, are thoroughly animistic, in the diffuse sense, and confuse animal and mechanical motion. At some later point in development, the child begins to use the term life as a concept, but his meaning of the term is much more inclusive than the adult's meaning, and he calls many inanimate objects alive. There is a long developmental process before he restricts life to animals. In the meantime, the child's explanations remain pre-causal until the time when he can make a definite and accurate distinction between life and non-life. As long as the child does not understand that there is a difference between animal movement and objects in motion, then his explanations for both will be motivational, in the larger sense, or non-mechanical.

Piaget studies diffuse animism, or precausality, by asking children to explain how and why certain events occurred. These events almost always involved motion, for Piaget felt that it was movement which generally called forth the diffuse

animistic schema of thought. Most frequently he questioned the children about natural phenomena (the movement of the sun, the wind, a river), but he also included one or two demonstration items which directly involved mechanical movement (the turning of a wheel by a small steam engine).

Piaget says that before the age of 7 or 8 the children's responses are generally precausal. This kind of explanation is characterized by a lack of attention to the details of how things happen, confusion about the temporal sequence of events, and disregard of the necessity for spatial contact between objects for the transfer of energy. The children's major emphasis is upon why things happen, rather than on how they happen. In particular, Piaget delineates nine different categories of precausal thought: Psychological, Magic, Participation, Phenomenism, Dynamism, Animism, Artificialism, Moralism, and Finalism. Specific examples and a full discussion of these categories will be given in the third chapter. Piaget indicates that older children give mechanical responses which are identifiable in terms of the characteristics which they possess in opposition to precausal explanations--attention to details, understanding of temporal sequences, and showing knowledge of the necessity of spatial contact for the transfer of energy. In addition, Piaget says that some of the older children use true logical explanation for some events. When children use these forms they say things of the form, "That happened because x is a y, and all y's do that."

In studying systematic animism Piaget asked children to tell him whether or not each of several items was alive or not alive, and to tell why they thought so. Thus the child was asked to classify the various items as alive or not alive, and then to provide justifications for those classifications. Piaget did not use a very extensive list of items to be classified, nor did he question each child about exactly the same items. Rather, his questioning depended, in part, on the responses given by the children.

On the basis of the children's classifications and justifications, Piaget distinguishes four stages in the development of the child's concept of life. In the first stage, the children are very animistic, attributing life to many objects, and referring to the use or action of the item as justifications for their judgments. In the second stage, Piaget contends, children restrict their concept of life somewhat, now saying that only things which move are alive. In the third stage, children restrict life to objects which move spontaneously. Finally, during the fourth and most mature stage, children attribute life only to animals and/or plants.

Thus, Piaget specifies a developmental model for describing how children learn to distinguish life from non-life. The model indicates that children initially misclassify many inanimate objects by calling them alive, and that they progressively restrict the number and kinds of objects called alive until only animals and/or plants are called alive. This restriction is

caused by or is accompanied by changes in the kinds of justifications children give for their classification of items as alive or not alive, and Piaget identifies three major justifications, which he uses to define stages in the development of the concept of life: use or action, movement, and spontaneous movement.

It must be noted that this model for describing the development of the concept of life is incomplete in some respects and that it has implications which are not empirically studied or, at least, not reported by Piaget. That is, there are some important aspects of the development of the concept of life which are not taken into account in Piaget's specification of his model. Furthermore, there are assumptions underlying the model or implications from it about which Piaget reports no data, presumably because these didn't become relevant until after he had formulated the model based on the data he already had. In the light of some later studies there is need to collect data relevant to these assumptions and implications.

There are three possible kinds of classification errors which children can make in terms of the concept of life. They can classify plants and animals as not alive, and they can classify objects as alive. The Piaget model predicts that children should make very few errors in classifying the animals about which they are questioned. The model also predicts that children should initially classify a great many objects as alive and progressively restrict the number of objects to the point where they deny life to any of them. Further, the model would suggest

that children would start out making very few plant classification errors and that they should remain at a low level. However, Piaget's report suggests that many of the children in his most advanced stage deny that plants are alive. He fails to indicate why this is the case and so the model remains unspecified in terms of plant errors. Thus, children are considered to be in the most mature stage when they classify the objects correctly even if they misclassify plants.

Another important aspect of the development of an adequate concept of life is left unspecified by the model in the form of a lack of description of the justifications which define or belong to the most mature stage. That is, the first three stages specified by the model are defined in terms of the justifications which children give for their classifications. On the other hand, the fourth stage is defined solely in terms of a lack of errors in classifying object items. Piaget gives no indication of the kinds of justifications given by these, most mature, children. This is certainly an important issue, for it is this justification which allows the child to finally free himself totally from animism. It does little good to simply say that in the fourth stage children know that only animals and/or plants are alive, since they must have some criteria for defining what constitutes an animal and/or a plant.

An important assumption underlying the model, about which Piaget presents no data, is that there is a decline in object errors from one stage to the next. That is, Piaget's model

specifies the first three stages in terms of the kinds of justifications given by children in a given stage. The assumption is that the use of this kind of justification leads to a reduction of errors in classifying objects as compared to the previous stage. Piaget's procedure prevented the collection or reporting of such data, since he used different items with different children, nor is it a particularly important issue for his work, which was to attempt to define the stages. On the other hand, the testing of this assumption would seem to be an important objective of any subsequent study of systematic animism.

There is one final assumption about which Piaget provides no information. That is, the model, as he has specified it, implies that children are consistent enough in their use of the justifications to be classified in terms of the first three stages. Although Piaget reports that, indeed, particular children are not completely consistent in their use of one justification, this again presents no problem for him, since he apparently extended the questioning of the child until he was convinced as to the most important justification for that particular child. However, this issue does present a rather serious problem for further studies, which attempt to use a more standardized questioning procedure and data analysis. In other words, because of his particular procedure, Piaget gives no explicit statement of how consistently a child had to use a justification in order to be classified into a certain stage. But the implication certainly is that children are fairly consistent, for otherwise it

could be difficult or even impossible to define stages in terms of their use of justifications.

Before ending this discussion of Piaget's work on animism, there are three other issues related to his discussions about systematic and diffuse animism which need explanation, since they are still relevant and represent major goals of the present study. The first of these concerns the relationship between systematic and diffuse animism. As indicated earlier, Piaget considers the two constructs to be different manifestations of the same characteristic of child thought. That is, systematic animism represents the child's progress in learning to distinguish between life and non-life while diffuse animism or precausality reflects his inability to make the distinction. He therefore argues, that when the child is no longer animistic in the systematic sense, that is, when the child can adequately distinguish life from non-life, then he will no longer give pre-causal explanations because he will realize that mechanical movement requires a different order of explanation than animal movement. Piaget does not give statistical evidence to support this contention. He does not indicate that he has questioned the same children concerning both constructs and concluded that children who are not animistic in the systematic sense also do not give pre-causal explanation. He simply indicates that in the groups of children which he studied, both systematic and diffuse animism tend to decline at the same age. Therefore, this is an issue which needs further study, by in-

vestigating the two constructs in the same children.

Another implication from Piaget's work on precausality concerns the effect of precausal thought on perception. In fact, Piaget describes precausality as a schema of thought, which directs and to some extent limits the child's perceptions, so that a particular experience is likely to be interpreted in terms of the schema rather than having the schema modified, all at once, to conform to a particular experience. In effect, Piaget is saying that the precausal nature of the child's thought allows him to construct almost any aspect of a situation as a cause and relate it to almost any event as an effect, ignoring the details of the event, the temporal sequence of the event, the actual spatial contact that occurred during the event. All of these are reality aspects for the adult and all effect his judgment of cause and effect. For the child the explanation serves as a barrier to the proper perception and understanding of reality. Thus, Piaget implies that children who think pre-causally may not be effected by repeated experience which contradicts their explanation, and they may fail to isolate the proper cause of an event even when given directly relevant experience. This issue, also has never received empirical test.

Finally, Piaget's discussion of systematic and diffuse animism implies that both of these constructs reflect a primitive and natural state of child thought, and are not simply superficial accidental phenomenon. Thus, he indicates that the

development from animism to non-animism reflects real cognitive growth by the child, and not incidental learnings or facts picked up as he grows older. Of course, it is quite difficult to prove this contention, but it is possible to compare the developmental status of the child in terms of these constructs with his developmental status as reflected on some other, more standardized measure of cognitive development. Thus, progression through the stages of systematic animism and the decline of precausality should be related to other measures of cognitive growth. The present study will concern itself with this issue also.

Almost as soon as reports of Piaget's investigations of systematic and diffuse animism were published, many of the issues raised above and others besides were discussed and Piaget was criticized on many grounds (Huang, I., 1930; Issac, S., 1930; McAndrew, B., 1943). It was pointed out that he gave almost no evidence concerning the number of children he questioned about different concepts. He never discusses any standardized measures of intelligence in relation to his data. He never presents statistical tables for evaluating any of his findings. Furthermore, his clinical method, consisting of open-ended conversations with no pre-determined format, was suspected in many quarters--perhaps he "suggested" the answers which the children gave. His developmental evidence was strictly in terms of the average age at which a particular form or stage of thought occurred, and many of his own examples deviated markedly from these

Key 7

averages. Finally, many authors felt that children's explanations should be studied only in terms of mechanical demonstrations since even adults may have trouble giving mechanical explanations for events like the movement of the sun or wind. Many studies of both systematic and diffuse animism were therefore planned and carried out to attempt to cure some or all of these ills. To reports of these studies we now turn.

Studies of Systematic Animism

Dennis (1943), Russell (1939, 1940a, 1940b, 1942), Russell and Dennis (1939, 1941), and Russell, Dennis, and Ash (1940) are all reports of a series of related studies which replicated and extended Piaget's findings concerning systematic animism. The authors used a standardized list of objects, animals, and plants to be classified by the children. They presented all of the items in a standard order, and asked for justifications in a uniform way. Their studies employed several hundred subjects, with a very wide range of intelligence test scores, from many different geographical locations and from homes of varied socio-economic class backgrounds. They all attempted to classify children in terms of Piaget's four stages, using the justifications which he described. All reports indicated that (1) children do attribute life to many inanimate objects, and (2) that over 90% of the children studied could be classified un-

ambiguously into one of Piaget's four stages. They also indicated that the stages were related to both chronological and mental age, the more mature children in terms of both variables tending to be in the more advanced stages. However, there were a great many exceptions to these major trends, with some of the youngest children and some of the children of lowest mental age being in the most mature stage and some of the oldest subjects and some of the subjects of highest mental age being in the least mature stages.

The results of these studies, therefore, seem quite clear-cut in their support of Piaget's contentions concerning the development of the concept of life in the child. However, besides using standardized techniques and other procedural controls, this series of studies did not extend the model to specify some of the unaccounted for issues, nor did it submit any of the assumptions underlying the model to any more rigorous test. No information is provided concerning the consistency with which children use the justifications, the exact relationship between justifications and object errors, the reason for plant errors (apparently these are still found among some children who are in Stage IV), nor the justifications used by children in the most advanced stages.

There was, however, one important extension made in these studies. They retested groups of their subjects on the animistic questionnaire after a three month interval. It was reported that

64% of the 325 children remained in the same stage after this period of time, 24% progressed, and 12% regressed to a lower stage. Almost all of the changes were movements of one or two stages. This data does suggest that there is some stability in the children's responses and classification over time. On the other hand, the analysis leaves a great deal to be desired. Children who progress from one stage to another presumably change their justifications (since their usage of these defines how they were classified into stages) and, also, the model predicts, would show changes in the number of errors which they make in classification. That is, progress from Stage II to Stage III implies that a child has shifted from using movement justifications to spontaneous movement justifications. It does not seem very likely that children in three months time, would change from using exclusively one kind of justification to exclusively using another kind of justification. Since there is no data available, on the consistency of use of justification by the children, it is not possible to support or reject this hypothesis on the basis of these studies. There is also no data reported on the changes in number of errors made as the children move from one stage to another. All of this suggests that any further studies of systematic animism should attempt to specify the model describing the development of the concept of life in such a way that particular hypotheses about changes in the use of justifications and the occurrence of errors could be stated and

tested. The present study attempts to do just this.

The most recent study of systematic animism (Laurendeau, M. and Pinard, A., 1962) carries the analysis of the data much further than the previous studies, but probably raises more issues than it solves. The experimenters administered an animistic questionnaire to five hundred children between the ages of four and twelve as a part of another, larger study. Their questionnaire consisted of fourteen objects, five animals and two plants--to be classified by the children. This will be further described in the next chapter.

The first problem which Laurendeau and Pinard encountered and the first discrepancy with the previous reports, is that a significant percentage of the children in their study use a justification not reported previously. They label this class of justification as anthropomorphic and indicate that it refers to cases where children gave as their justification some characteristic which is associated with human beings--walking, talking, thinking, seeing, breathing, growing, having arms, etc. The authors reported that they also had difficulty in distinguishing movement justifications from use or action. When a child said that a bell is alive because it rings, was he referring to the usual activity of a bell, or to the motion it makes when it rings? Therefore, they did not try to separate these two categories for their data analysis.

The next problem reported by Laurendeau and Pinard was

the fact that children were inconsistent in their use of the different categories of justification. They found that for the twenty-one items on the questionnaire, children often gave more than one or even several different justifications. This finding is quite different from the information implied by the previous studies, and, of course, has serious implications for further analysis of the data, in their study. Piaget and the Russell and Dennis group operationalized the model by categorizing the children into groups on the basis of justifications. They reported no rules or objective procedures stating how often a child must use a particular justification in order to be placed into a certain stage, and the implication is that this presents no problem--presumably because the children are consistent in their use of justifications for the different items on the questionnaire.

Thus, Laurendeau and Pinard had no precedents for deciding how to classify the children given the large amount of inconsistency. Since their major interest was in standardizing a series of items dealing with cognitive development, rather than specifically studying systematic animism, they proceeded to make the most convenient groupings of children based as much as possible on the previous work. They did not pursue any of the issues relating to the model which have been raised here.

Using the information from the previous studies, Laurendeau and Pinard defined the most mature stage as children

who classified all of the object items correctly, i.e. children who were not animistic. Since they felt it was impossible to distinguish between movement and use of action, they were able to construct only one intermediate stage, based on spontaneous movement justifications. However, since the children were so inconsistent in their use of justifications, it was necessary to specify a certain number of usages of spontaneous movement in order to reliably classify the children. They decided to use a criterion of at least one use of the spontaneous movement justification for classifying the children into the intermediate stage. It was assumed, then, that children in the most primitive stage were those who gave use or action, movement, and anthropomorphic justifications.

This set of procedures for defining three stages in the development of the life concept really emphasizes the need for the kinds of analyses suggested previously in this paper. There is no evidence that this three stage classification represents any more than a convenient way of dividing up the children. That is, the authors present no data which suggests that their two primitive stages represent important phases in the children's cognitive development as they learn to distinguish life from non-life. The only necessary difference between Stage I and Stage II children is that the latter use spontaneous movement at least once as a justification, (it is possible that their average usage is much higher than this, but no evidence is presented). Further-

more, the authors present data concerning the number of errors in the classification of objects made by the children in Stages I and II, which only increases the doubts about the validity of the stages. Although this error data is not precise enough to make statistical comparisons of the differences in errors between the groups, the tables suggest quite strongly that Stage II children, on the average do classify fewer of the objects as alive. However, it is also true that thirty-nine of the one hundred thirty-five children classified as being in Stage I make only one or two errors in classifying the object items and are hence not very animistic, while nineteen of the eighty children in Stage II make five or more errors in classifying objects and are hence quite animistic. Thus, the application of the model in terms of the criteria set up by Laurendau and Pinard really provides even less information about the development of the concept of life than the system used by the previous authors. On the other hand, their analysis suggests very strongly that the consistency of use of justifications by children implied by the previous work is not to be accepted unquestioned, and that in fact, it should be the first analysis carried out in any future study, before any attempt to classify the children into stages is made. It also implies that any future study must seriously concern itself with establishing the relationship between justifications and errors in order to insure that any stages defined do reflect real differences in the devel-

opment of the concept of life. The specific implications of this will be presented in the final section of this chapter.

Studies of Precausality

There have been four attempted replications of Piaget's findings concerning precausal explanations by children, using mechanical demonstrations. All four have produced negative results, i.e., have claimed that precausal thought does not exist, at least in relation to mechanical demonstrations. However, each of these studies is in some way inappropriate or inadequate in terms of Piaget's theory of the phenomenon, and, therefore, the results are taken to be inconclusive.

Deutsche (1939) studied seven hundred thirty-two children between the ages of eight and sixteen, in groups in their classrooms, and required the children to write their explanations of the demonstrations. Since Piaget suggests that pre-causal thinking usually declines between the ages of seven and eight, the subjects in Deutsche's study are not really appropriate and may have already passed out of precausality. Furthermore, having the children write their responses to the questions is a poor methodological choice. Eight year old children are not particularly proficient in translating their thoughts into written words, and in this situation it is impossible to encourage additional responses or to probe for the meaning of a

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response. Deutsche herself indicates that many of the children's responses could not be classified in terms of the Piaget system because they were incomplete.

Huang (1930) saw the subjects in his study individually, and they were six and seven year olds. However, many of his demonstrations did not involve movement, although Piaget suggests that motion most frequently calls forth the precausal responses. Furthermore, Huang calls many of the responses which the children give "naive," and it does appear that many of these might be classified as precausal by Piaget. Finally, the majority of the children in Huang's sample were from professional and academic homes, and it seems very likely that they were quite advanced in intellectual development. Therefore, the possibility exists that many of them might have already passed out of the precausal period.

McAndrew's (1943) subjects were of an appropriate age, but it appears that they too were of well above average intellectual development. Moreover, a great many of the sample explanations which she presents that were given by the children and which she says are mechanical, would quite clearly be classified as precausal by Piaget.

Jones and Arrington (1945) report a replication of the Deutsche study, using the same demonstrations which she employed. They also studied subjects who were all over eight years old and also required written responses to the questions. Thus, the same

criticisms apply to this study as to the Deutsche investigation, and it, too, seems inconclusive.

In view of these problems, it seemed worthwhile to undertake another study of precausal thought, attempting to correct for the above inadequacies. A recent replication by Laurendeau and Pinard indicates that children still give pre-causal explanations for natural phenomenon, so the study seems all the more worthwhile. The particular issues will be specified in the next section.

Objectives of the Present Study

In view of the problems and issues raised in the previous work, there are four general areas of concern for the present study: (1) the specification and testing of a more precise model for describing the development of the child's concept of life; (2) another attempt to demonstrate the existence of pre-causal thought in the child in relation to mechanical demonstration; (3) empirical study of the relationship between precausal thought and systematic animism in the same children; (4) the relationship between precausal thought and a causal learning task; and (5) the relationship between precausal thought and systematic animism and a standardized measure of intelligence. Each of these areas will be discussed in terms of the specific questions

relating to each in the paragraphs to follow.

All of the previous studies of systematic animism have indicated that a large percentage of young children attribute life to inanimate objects and this tendency declines with increasing age. They have also suggested that children use several justifications for classifying items as alive or not alive, including, possibly, use or action, movement, spontaneous movement, and anthropomorphic characteristics. There has been the consistent suggestion, with some support, that spontaneous movement is a more mature justification than use or action or movement.

On the other hand, since the time of Piaget's original specification of his model for describing the development of the concept of life, there have been several unexplored issues. None of the studies give systematic data about the consistency with which particular children use justifications for different items. Laurendeau and Pinard suggest that there is a great deal of inconsistency, but their data are presented in such a way that the only certain conclusion that may be drawn is that very few of the children (only twenty-five out of five hundred) use only one category of justification for all twenty-one items. This is obviously an important issue since the classification of children into stages has always been based on the kinds of justifications which they use. If, indeed, there is a great deal of

inconsistency, this procedure may be impractical and unjustifiable. None of the previous studies have offered any evidence to support the assumption that there is indeed a reduction in object errors from Stage I to II to III. This issue becomes especially critical if stages are to be arbitrarily defined in the manner of Laurendeau and Pinard who set a precise numerical number of times that a justification may be used for a child to be placed in a particular stage. All of the studies have implied that many children in the most mature stage, who are not animistic, deny that plants are alive, but no one has extended the model in an attempt to account for these errors. In fact, none of the studies have presented any precise figures concerning the frequency with which plant errors occur. If they are a frequent phenomenon, then a complete model must attempt to account for them. Finally, none of the previous studies have reported any data concerning the kinds of justification used by children in the most mature stage, nor have they suggested any specific possibilities. Any future study would have to concern itself with this issue.

In view of the above problems, the present study was designed to administer the same questionnaire used by Laurendeau and Pinard to a group of children in roughly the same age range (this questionnaire is quite similar to the one used by Russell and Dennis, which in turn contained many of the items used by

Piaget), but to proceed differently in the analysis of the data. Thus, the first issue would be to attempt to categorize all of the justifications used by the children, based on the categories of justification used in earlier studies. This will insure that every justification is available for analysis. The next necessary step will be to examine the consistency with which children use the justifications, in order to determine if, indeed, stages may be defined in terms of the justifications. If the children are consistent enough in their use of the justifications, then they may be classified into groups on the basis of the justifications, and it will then be possible to statistically test the differences in errors made in classifying object, animal, and plant items. This should indicate if there is any need to further combine the justifications in order to make up meaningful stages--children who are classified in terms of their justifications and who make different numbers of errors of classification. If on the other hand, there is not enough consistency in the use of the categories of justification, then it will be necessary to turn to an analysis of the relationship between particular kinds of errors when children use particular justifications. That is, instead of grouping the children, an analysis will be made of the overall association between plant, animal, and object errors, and the use of different justifications. Then it should be possible to specify groups of children in terms

of the kinds of errors which they make and to predict the kinds of justifications used by such children. Hopefully plant errors could be included in the specification of the model, and it should be possible to discover what kinds of justifications are used by children who do not classify plants as alive. This, then, would allow for a specification of the extended model in such a way as to overcome the inadequacies found in earlier studies. Furthermore, it was a goal of the study to specify the groups of children in such a way that predictions could be made about changes in their responses which should occur as they moved from one group to another over an extended period of time.

The second objective of the present study is to attempt to discover if, indeed, children do give explanations for mechanical demonstrations which can be reliably classified in terms of Piaget's precausal thought system. Earlier studies have indicated that children do not give pre-causal responses to demonstrations, but they have used inappropriate subjects (too old or too mentally advanced), insufficient methods for data collection (requiring children to write their responses), and, on occasion, inadequate analysis of the children's responses (they did not seem to sufficiently understand Piaget's description of pre-causal thought). Thus, the present study will employ very young children (as young as four years old), including many subjects in the average range of intelligence, and will individually ques-

tion the children and encourage them to verbalize their explanations. If it turns out that children do give pre-causal responses, then data will be presented to indicate whether or not the particular categories of pre-causal thought described by Piaget are exhaustive and are all used frequently by young children for explaining many different kinds of events, or if particular categories of pre-causal thought seem to occur very frequently in connection with some events and infrequently in connection with other events. That is, it is possible that Piaget's general description of pre-causal explanation is essentially correct, but that the particular categories which he gives are specific, more or less, to certain kinds of events. If the children do give pre-causal explanations, then these should also be related to age and should show a decline at about the age of seven or eight, according to Piaget.

Piaget's discussion of systematic and diffuse animism indicates that they are intimately related, and in fact, are both expressions of the same characteristic of children's thought. He also indicates that it is the ability to distinguish accurately between life and non-life which leads the child to cease giving pre-causal explanations and begin to give truly causal ones. This contention has never been empirically tested. The present study will attempt to evaluate whether or not there is indeed such a relationship by examining the same children about both constructs

at the same time. Then it should be easy to test whether or not children who have ceased to be animistic give more mechanical explanations, or better ones, than children who are still animistic.

The present study will attempt to test the implication from Piaget's theories about animism that children who give pre-causal responses are prevented from profiting directly from experience in regard to cause-effect relationships. The study will attempt to provide the children with a learning situation in which they will need to correctly identify the cause of an action in order to be able to successfully predict an outcome. If they have failed to learn the relationship after several trials, then they will be given additional experience, in which the causal relationship is taken out of the test situation, directly relevant to learning the relationship. Then they will be given an additional chance to demonstrate that they have learned the relationship. It is predicted that children who give pre-causal responses for the outcome of the event, will not learn the relationship, even with the relevant experience.

Finally, the present study will attempt to evaluate the relationship between a standardized measure of intelligence and development in terms of systematic and diffuse animism. Piaget implies that both of these constructs are primary and essentials of child thought. As such, it would be expected that children's

development in terms of them would be related to other measures of intelligence.

Chapter Two

SUBJECTS AND METHODOLOGY

The Selection and Composition of the Sample

Ninety-six subjects were selected and tested for the present study. Sixteen children were chosen from each of six age groups: four to five years, five to six years, seven to eight years, eight to nine years, and nine to ten years. For most analyses these six age levels were combined into three: four to six years, six to eight years, and eight to ten years. Half of the children at each of the age levels were boys and half girls.

The children were tested with the Peabody Picture Vocabulary Test at the time when they were first seen. The mean I.Q.'s of the three age groups of children are slightly above 100 (105, 104.5 and 105, for the four to six, six to eight, and eight to ten year old groups, respectively), but all within the normal range. There is a very wide range of scores for each of the three age levels: 71-144 for the four to six year old group ($\sigma = 17.9$), 72-136 for the six to eight year old group ($\sigma = 19.6$), and 62-132 for the eight to ten year old group ($\sigma = 15.4$). The mean I. Q. for the standardization sample of the Peabody Test is 100, with a standard deviation of 15.

The children were selected from four different schools in Durham. The four to six year olds came from a university preschool and from a church nursery school. These two schools were chosen to provide children of different family backgrounds in terms of socio-economic class, education of parents, and general experiences. The fathers of most of the children in the university preschool had academic or professional positions, while the limited information available indicated that the fathers of the church school children were lower on the socio-economic class scale--many being salesmen, clerical workers, civil servants, and so on. In addition, many of the mothers of these children worked also.

The children in the six to eight and eight to ten year old groups came equally from two Durham Public Schools. The children from one of these were chosen randomly from complete class-room lists provided by the principal. The principal of the other school felt that it would be necessary to obtain approval from the parents before the children could be seen, so letters were sent home with all of the children and the subjects for the study were chosen randomly from the group whose parents sent back their consent. The resulting pool of children was a great deal larger than the number of children selected from it, and since both the home background and intelligence scores of these children represented a very wide range, there was no obviously biasing effect to this procedure. A brief check of the school records indicated that the children from these public schools came from

homes of many different socio-economic class levels in that their fathers were in many different kinds and levels of occupations. There were many professional occupations listed as well as a great many managers, salesmen, clerical people, truck drivers, and semi-skilled and unskilled workers.

It is fairly evident then, that the very lowest levels of the socio-economic class scale are under-represented in the sample, and no Negro children were included. With these exceptions, it would seem that the methods of selection, the intelligence test scores and the limited data on home backgrounds, all support the contention that the subjects adequately represent the general population, so that the results obtained should be widely applicable. Furthermore, the selection process was specifically responsive to the requirements of the study. One of the major criticisms of the demonstration studies of precausal thinking was that the two studies which used large numbers of children included none younger than eight years old, although Piaget indicates that precausal thinking largely disappears before this age, and that the other two studies which did subjects under eight years old, included a large proportion of subjects who were well above average in intellectual development and who might have already progressed beyond precausality in spite of their younger chronological age. The children also represent a large enough age range so that the different developmental levels of the systematic animism construct should be evidenced by significant numbers of children.

Methodology

In view of the objectives of the study described in detail in the introductory chapter, four different kinds of procedures were included in the test battery: a questionnaire for studying systematic animism, a series of demonstrations to be explained by the children to study precausal thought, a causal learning task for studying the relationship of precausal thought to learning a cause-effect relationship, and a standardized intelligence test to provide an independent measure of cognitive growth with which the children's developmental level on the other constructs could be compared. The children were seen individually, in quiet rooms provided at the various schools. The children were originally seen in the fall of 1964 and at that time were given the animistic questionnaire, the eight demonstrations and the intelligence test. Approximately six months later (two weeks more or less), in the spring of 1965, the children were seen again for retesting on the animistic questionnaire and for the causal learning task. Eighty-eight of the ninety-six children were relocated for this second session (thirty of the four to six year olds, thirty of the six to eight year olds, and twenty-eight of the eight to ten year olds). The others had moved, changed schools, gone on extended trips, or had prolonged illnesses.

The first instrument in the test battery was the animistic questionnaire used by Laurendeau and Pinard. The point of

interest for the present study was the analysis of the results of the questionnaire, and changes would have made strict comparability with previous studies more difficult. The tasks presented to the children by the questionnaire were the two previously described--the classification of a list of items as alive or not alive, and the justification of these classifications. The twenty-one items on the list were (in order): mountain, sun, table, automobile, cat, cloud, lamp, watch, bird, bell, wind, airplane, fly, fire, flower, rain, tree, snake, bicycle, fish, and pencil. The list thus includes fourteen objects and natural phenomena, five animals and two plants. The objects included represent things that are obviously useful and things that are not particularly useful, things which move and things which do not normally move, things which rather obviously (to the adult) are moved by external forces, and things which might well appear to move spontaneously. Thus, the objects are well suited to allow the child to display any of the justifications which Piaget says define the four different stages in the development of the concept of life.

The next item in the test battery consisted of eight mechanical demonstrations performed in the presence of the child and which the children were asked to explain. These were chosen so that they involved movement or apparent movement, since Piaget indicated that it was motion which generally elicited the pre-causal explanations. Each of the items was presented in the same order to all of the children and was followed by a standard

question. If the child did not give an adequate mechanical explanation of the demonstration, the experimenter went on and asked several other, non-standard questions in order to get the child to give the most complete and detailed explanation of which he was capable. The forms of the standard questions were varied from demonstration to demonstration for it was thought that this might effect the children's answers. This did not seem to be the case, for the children gave no indication that they distinguished different forms of questions such as "How does that happen?" "Why does that happen?", or "What makes that happen?"

Some of the demonstrations were either identical or very similar to items used by other experimenters who studied pre-causal thought. This was done mainly in order to keep the situations as constant as possible so that differences in results might be attributed to the age of the subjects, the individual administration, and the handling of the responses, rather than due to completely different tasks for the children. Furthermore each of the previous authors did use some items that appeared quite adequate in terms of Piaget's discussions of pre-causal thought.

For the first demonstration, the experimenter took a small balloon from a package and blew it up. The child was asked to watch carefully, the balloon was released and allowed to fly up in the air and around the room. The child was asked, "What makes the balloon do that?"

For the second demonstration, a test-tube with a small quantity of water in it and a cork securely fastened in its neck was placed over a candle which the experimenter had lit with a match. When the cork popped out of the tube, usually landing on the other side of the room, the child was asked, "Why does the cork do that?"

For the third demonstration, a small cube of wood was placed on top of a plastic playing card. The experimenter placed a finger on one edge of the card and showed the child that as he moved the card around, the block moved with it. Then, the card was placed on the edge of the table, and the experimenter gave it a quick flick with his fingernail, sending it shooting across the table while the block remained standing in the same place. The child was asked, "Why did the block stay in the same place that time?"

For the fourth demonstration, the experimenter showed the child a small cardboard box with very low sides. A string about eight inches long was attached through the center of each of the four sides, and all four strings were joined in a knot at their ends. A penny was placed in the box, and the box was swung upside down with the experimenter holding the string. The child was asked, "What keeps the penny in the box?"

For demonstration five, the child was shown a square jar containing some blue colored water. Into this was inserted a large (about a foot long) meat baster--a clear plastic tube, with a yellow rubber bulb on top of it. It was placed in the jar of

water with the bulb squeezed. The experimenter released the bulb and the blue liquid proceeded slowly up the tube. The child was then asked, "What makes the water go up inside the tube?"

The material for demonstration six was an ordinary red rubber ball of about two inch diameter. It was thrown to the floor by the experimenter and caught when it bounced back up. The child was asked, "Why does the ball come back up?"

Demonstration seven was a "magic" trick. The child was shown a small, cup-like figurine on a stand, with a top. When the top was removed there was a small red ball inside. The experimenter showed this to the child, and then placed it in his pocket. The top was placed back on the cup, and the experimenter rubbed it gently for a moment with his hand. When the top was removed again, it appeared that the red ball was back in the cup (actually the top had a false partition, so that a half-ball fell into the cup when released by the experimenter). The child was asked, "How did the marble get back in the cup?"

Demonstration eight consisted of a small (four inch) propellor mounted on a wooden stand. The shaft of the propellor was attached by a rubber band to a tiny electric motor beneath the propellor and shaft. A wire leading from a visible battery was attached to the motor, causing the rubber band, shaft and propellor to turn. The child was asked, "Why does the propellor do that?"

The third item in the test battery was a causal learning task created by the experimenter. It consisted of a somewhat U-

shaped chute made from a venetian blind, and some small, colored balls. The chute was built upon a wooden frame, with the two ends of the chute supported by vertical wooden slats and the bottom of the U attached to the horizontal wooden plank. Actually, the two ends of the chute were not vertical nor parallel to one another but rather sloped outward from the center, with one end about four inches longer (and hence higher) than the other.

There was a small nail visible where the chute was attached to the horizontal plank, and there were two holes in the chute which were the places where the cords of the venetian blind had been. Four different balls were used on this chute, two small and two large, one of each size being red, and one being yellow. When the balls were placed on the longer chute about an inch above where the vertical support slat joined the chute, and were released, they went flying off the other end of the chute. When they were placed about an inch below this juncture, they all failed to go off the other end of the chute.

The child was shown the four balls and chute, the first ball was held up to the appropriate place on the longer end of the chute, and the child was asked to guess whether or not the ball would go off the other end. After his guess had been recorded, the experimenter released the ball. Then, another ball was held on the chute and again the child was asked to guess. Each of the balls were used on two different trials, once being allowed to go off, once being placed at the lower position so that they failed to go off. The order of presentation was the

same for all children as follows: (1) the small red ball, stays on; (2) the large yellow ball, goes off; (3) the small yellow ball, goes off; (4) the large red ball stays on; (5) the small red ball, goes off; (6) the small yellow ball, stays on; (7) the large red ball, goes off; and (8) the large yellow ball, stays on. It was assumed that the younger, presumably precausal children would connect the size and/or color of the balls with the subsequent end of the run and never modify their explanation or perception of the cause and effect relationship even in the face of contradictory evidence--since every color and size both stayed on and went off an equal number of times.

As soon as a child correctly predicted four successive trials, he was asked to explain how he could tell whether the ball would go off or stay on, and the testing was terminated. If the child failed to reach this criterion by the end of the eight trials, he was given more direct experience. The experimenter took one of the balls, and placed it fairly high up on the starting side of the chute, but not far enough up so that it would go off. The child was told to watch carefully, and the ball was released and allowed to run almost all of the way up the other side of the chute and then fall back down. Immediately afterward, the same ball was placed very much lower down on the starting side of the chute and again released so that it now traveled much less farther up the other side. Immediately both the high and low trials were made again. Finally, the child was given four more

trials for which he was again asked to predict whether the balls would go off or stay on. These four trials were (1) the small yellow ball goes off; (2) the small red ball, stays on; (3) the large yellow ball, stays on; and (4) the large red ball, goes off. Again, the children were all asked to tell how they knew whether or not the ball would stay on or go off.

The final item in the test battery was the Peabody Picture Vocabulary Test. This test was selected as a measure of intelligence because it is one of the few tests that has been well standardized with children as young as four years old, is easy and quick to administer and its scoring is maximally objective. In addition, it correlates very highly with the Stanford-Binet, long the outstanding instrument for measuring intellectual development in young children. The scores from the test were used as an independent measure of the intellectual development of the children in the sample with which the other measures could be compared.

Chapter Three

DATA ANALYSIS AND RESULTS

The First Administration of the Animistic Questionnaire

In the introductory chapter a number of questions concerning systematic animism were raised which were to be answered by the present study. These will be briefly reviewed here, together with the kinds of analyses which they lead to. In view of the earlier work, the first question to be answered concerns the justifications used by the children for their classification of the items on the questionnaire. That is, are the three categories suggested by Piaget, or the three suggested by Laurendeau and Pinard, or some other set of categories, sufficient to classify all of the children's responses? To answer this question it will be necessary to attempt to make the classifications and to then determine how many categories are needed. The second question concerns the consistency with which children use particular justifications for the twenty-one items on the questionnaire. That is, do children use the categories consistently enough so that objective stages may be meaningfully defined in terms of the kinds of justifications used? This analysis, too, is rather straight-forward and simply requires examining a compilation of the frequencies of usage of the various categories

of justification by individual children to see if, indeed, many children tend to use one kind of justification for most of the items on the questionnaire. The next question to be answered concerns the relationship between the children's use of justifications and their errors in classification of the items on the questionnaire as alive or not alive. That is, does the use of certain kinds of justifications lead to certain kinds of errors? The data analysis relevant to answering this question will depend on the outcome of the previous analysis. If the children can be meaningfully grouped into stages in terms of their use of justifications, then it will be possible to statistically compare the kinds and numbers of errors of classification made by children in these different groups. If, on the other hand, the children's use of justifications cannot be used as a basis of grouping into stages, then it will be necessary to examine the relationship between errors and justifications for different kinds of items, disregarding, for the moment, children. That is, it will be necessary to tabulate the frequencies with which particular kinds of errors occur when particular justifications are used, for both plant and object items. From this analysis, it should then be possible to specify the application of a model such that (a) groups of children are defined independently in terms of different numbers and kinds of errors so that the differences in use of justifications by such groups of children can be statistically tested, (b) plant errors can be accounted for, (c) justifications leading to correct classifications of object items will be known, (d) the groups represent developmental

levels--that is, they should differ in terms of chronological age and, more importantly, in terms of level of cognitive development as defined by some independent, standardized measure and (e) some precise predictions about changes in use of justifications as children move from one stage to the next over a period of time can be made.

In order to categorize all of the justifications given by the children, the analysis was begun with the four categories which were used in previous studies: Use or Action, Movement, Spontaneous Movement, and anthropomorphic characteristics, first included by Laurendeau and Pinard, and here called Life Characteristics, since often these characteristics applied to more living things than only man, e.g., breathing, eating, walking. The difficulty which Laurendeau and Pinard had in distinguishing between Use or Action and Movement was found to be unimportant by this author. A justification was classified as movement only if it included a response indicating a definite and explicit change of place ("it moves," "it goes about," "it falls," "it rolls," etc.). Use or action, then, included any action which did not specifically denote movement ("it rings," "we can climb on it," "it tells us time"). It is true that we cannot know that the child was not thinking of movement when he talks about a bell ringing, but this is somewhat beside the point. What is important is that the two categories can be consistently and reliably classified as different. This can be done, so that the distinction was maintained for the preliminary analyses in this study.

It quickly became evident that some additional categories were required if all of the responses were to be unambiguously classified. Many of the children responded that they did not know why they said an item was alive and others simply did not answer. Therefore, a No Answer category was added for these responses. It was also found that many of the children's responses took the form of saying that the item did or did not run, walk, climb, jump, fly, swim, crawl, or wiggle. It was not clear whether these responses should be classified as movement or as Life Characteristic responses, since, logically, they could belong to either. Note that these responses were clearly distinguishable as a separate category--any response which referred to movement normally associated with animals or man. It is not clear whether the children who gave them were thinking primarily of the motion involved in these actions, or whether they were thinking of them specifically as animal characteristics. It was decided, therefore, to retain these Locomotion responses as a separate category until initial empirical analyses were completed and some evidence for their membership in one of these other categories could be established. Finally, many of the children said things such as this: "The sun is not alive because God made it," "A car is alive because it has a motor," "A bell is not alive because it is made out of metal." There were many other, similar responses reflecting widely varying degrees of adequacy, relation to reality, explicitness, and reasoning ability. None of these seemed to belong to the other category.

ries of justifications, so it was decided to classify them separately as Pseudo-logical or Logical justifications, since their form was related to deduction and classification.

A list of these categories, along with definitions and examples of them appears in Table One. The experimenter made all of the categorizations used in the data analysis, and found little difficulty in placing the great majority of the responses. An independent rater categorized 250 of the justifications (from the total of 2016) and the agreement between the two classifications was slightly greater than 93%.

A preliminary examination of the data confirmed what was implied by Laurendeau and Pinard's study--namely that children are too inconsistent in their use of the categories of justification to be objectively classified into stages on this basis. Therefore, it is now necessary to turn to an analysis of the relationship between classification errors and the use of justifications as suggested above and in the introduction.

In order to determine which kinds of justifications were associated with which classification errors, a tabulation was made of the frequency with which a particular item was classified successfully or unsuccessfully when a particular justification was used. Table Two represents a summary of these tabulations for all of the object items (14) on the questionnaire. The individual item analyses are in Appendix A.

Piaget's work suggests that Use or Action justifications should be associated with the greatest number of errors in object

Table I

The Seven Categories of Justifications

- 1) Life Characteristics: Any justifications referring specifically to characteristics associated with humans, animals, or plants. Example: growth, death, feeling, thinking, wanting, eating, drinking, smelling, possession of hands, eyes, mouth, head, etc.
- 2) Movement: Any justification referring to a change of position or place of the object, that was not qualified in terms of the source or motive of the movement (internal or external). Examples: "it moves," "it goes about," "it falls," "it rolls."
- 3) Use or Action: Any justification which referred to the usefulness, habitual or usual use of, purpose for, or action not specifically indicated as movement, of the item. Examples: "a bell is alive because it rings," "a flower is alive because it is pretty," "a car is alive because we can drive it," "a watch is alive because it tells us time."
- 4) Spontaneous Movement: Any justification indicating movement with an indication that the movement is caused internally or externally. Examples: "It moves by itself," "We make it go," "We have to drive it so it can move," "No one pushes it."
- 5) Locomotion: Any response which refers to movement characteristic of animals or people. Examples: walking, running, flying, swimming, climbing, jumping, crawling, wiggling, hopping, etc.
- 6) Logic or Pseudo Logic: Any justification which did not fall into one of the above categories and which had a more or less deductive form. Examples: "A car is alive because it has a motor," "A tree is alive because it is a plant (and, perhaps, 'all plants are alive')," "Rain is alive because God makes it alive."
- 7) No Answer: Any answer that indicated the child didn't know or wish to give a justification. Examples: "I don't know," "I can't remember," "Just because."

classification, Movement justifications with somewhat fewer errors, and Spontaneous Movement with even fewer errors on these object items. Furthermore, Laurendeau and Pinard suggest that Life Characteristic justifications should also be associated with many object errors, since they call it a primitive justification, to be classified with Use or Action and Movement. Locomotion should also be associated with many object errors, since it should belong with either Life Characteristic or Movement justifications, both predicted to be associated with many errors. No prediction can be made for Logic or Pseudo-Logic since it has not been mentioned in previous studies and since it is somewhat of a residual and mixed category.

Table Two indicates that indeed, Use or Action, and Movement justifications are associated with the largest number, and the largest proportion of animistic classifications. There is also some slight support for Piaget's contention that Use or Action is more primitive than Movement as a justification for distinguishing life from non-life. That is, a higher percentage of mistakes in classification of objects are made when children give Use or Action justifications (56.3%) than are made when Movement is used as a justification (42.6%). This contention receives some further support from the individual item frequencies to be found in Appendix A, since table, lamp, and mountain, the three objects on the questionnaire which are not normally associated with movement, are also the three items which are least frequently called alive. However, since these items are so infrequently called alive, it is not possible to reliably infer that

Table II
Justifications and Errors- Object Items

	Life Characteristics	Use or Action	Movement	Locomotion	Spontaneous Movement	Logic or Pseudo Logic	No Answer	Total
Correct	303	110	91	37	120	226	161	1129
Incorrect	10	142	85	10a	4	32	13	296
% Errors	3.2	56.3	42.6	21.3	3.2	12.4	7.5	20.8
Total	313	252	176	47	124	258	174	1425

a all 10 errors for "airplane"

children who give Use or Action justifications will classify them incorrectly. Therefore, the notion that Use or Action justifications are more primitive than Movement justifications needs further support in order to be accepted unquestionably.

The second fact of importance to be noted in Table Two concerns the Life Characteristic justifications. It is quite surprising to note that these are the most frequently used of all of the justifications (they were not even one of the categories of justification in the Piaget and Russell and Dennis studies) and that they are associated with very few object errors (they were classified as primitive justifications by Laurendeau and Pinard). In fact, when they are used, objects are correctly classified almost 97% of the time. This would suggest that rather than being the primitive justifications suggested by Laurendeau and Pinard, that they probably represent the crucial step in the decline of animism. That is, children who use Life Characteristic justifications commit very few animistic classifications of objects. It may be, then, that Life Characteristic justifications are the ones used by children in the most mature stages of Piaget and the other investigators. Key

The next finding of interest from Table Two is that Spontaneous Movement justifications are also associated with a very low percentage of errors, in fact with almost exactly the same percentage as Life Characteristic justifications--less than 4%. This suggests that Spontaneous Movement is not really a transitional justification, as was suggested by Piaget and others, but rather that it is also a crucial justification for the complete

reduction of animism. That is, many object items on the questionnaire were chosen for the express purpose of presenting children with objects which might appear to them to move spontaneously and hence might be called alive on that basis. However, it appears that children who use this justification do not make any significant number of errors in classifying objects. It therefore seems very likely that Spontaneous Movement actually is just a special case of Life Characteristic Justification. Not only are the two associated with the same very small proportion of errors, but also (1) Spontaneous Movement justifications are infrequent compared to most of the major categories of justifications and (2) indeed, spontaneous movement is characteristic only of living things, inanimate things never really move spontaneously and apparently children who use the justification already know this.

Earlier in this section the question was raised as to whether Locomotion justifications are better classified with Life Characteristics or Movement. The figures presented in Table Two are not really conclusive on this point, since the proportion of errors associated with the use of this category of justification is somewhere between those associated with Movement and Life Characteristic justification. However, all ten of the errors that occurred in classifying the object items in association with locomotion occurred for the airplane item on the questionnaire. When children said that the airplane was alive (or not alive) because it flies, this was called a Locomotion justification. It appears now, that this particular

classification of a justification was a mistake and that the children who said it were referring to the Use or Action or Movement of the airplane. Children who used locomotion justifications, made no other classification errors, so that, in reality, this justification is also probably a Life Characteristic justification. It should be noted that Locomotion justifications were used much more frequently with animal items on the questionnaire.

Finally, the relationship of Logic or Pseudo Logic to errors of classification must be considered. As suggested earlier, this is somewhat of a residual category with several different kinds and levels of responses included, and with no clear-cut relationships to the other kinds of justifications. In terms of percentage of errors of classification associated with usage of Logic or Pseudo-Logic, it is also not clearly related to the other categories of justification. That is, the percentage of errors associated with it (12.4%) is much lower than those for Use or Action and Movement (56.3% and 42.6%, respectively) and much higher than for Life Characteristics or Spontaneous Movement (3.2% for both). Thus, there is little indication in this data of a relationship between this justification and others. In going back over the responses that were classified as Logic or Pseudo-Logic, it appears that indeed they are a diverse group, but there are some suggestions for future studies. It appears that several of the children who gave them were really thinking of characteristics which are in opposition to life characteristics. That is, when a child said that a bell

is not alive because it is made out of metal, he might also have been thinking that metal is not alive because it can't eat, breathe, talk, see, etc. It must be noted that this is merely an impression, but it receives some support from the one child who, it is discovered, did say "a car is not alive because it's made out of tin and tin can't move by itself," and another who said "a pencil is not alive because it is made out of wood and wood can't talk." These children's responses were classified as Life Characteristic responses, and it is possible that the other children, whose responses were classified as Logic or Pseudo-Logic might have provided this kind of elaboration had they been questioned further. Another kind of response included in this category were those of the sort "a car is alive because it has a motor." It seems very possible, that these children really were thinking of the usefulness of the car or its movement, as was the boy who said, "A car has a motor that makes it move." Perhaps further questioning could have revealed more of this kind of thinking also. There were also included in the Logic and Pseudo-Logic category, responses that really seemed to reflect actual teachings of the child. That is, several children said, "The car is not alive because God doesn't make it alive--only God can make things alive." A few of the children went on to add that their parents or teacher or someone had taught them this. Finally, many of the children gave true, accurate logical responses, such as, "A tree is alive because it is a plant and all plants are alive." This is a perfectly legitimate answer, although it gives no clue as to what charac-

teristics of things tell this child what are plants and what are not plants. He has evaded this question of interest for the study. These kinds of responses were always probed, but seldom would the children elaborate. Thus, upon reexamination it still appears that many of the responses included in this category of justification simply are different in kind from the other categories of justifications, but some of them probably do represent children's thoughts that are on the same dimensions included in the other categories.

To summarize, for inanimate objects, Use or Action and Movement justifications are associated with the greatest proportion of errors, while Life Characteristics, Spontaneous Movement, and Locomotion justifications are all associated with very few errors. Thus, the contention of Piaget and others that Use or Action and Movement are primitive justifications is upheld. On the other hand, it appears that Locomotion and Spontaneous Movement can both be combined with Life Characteristic justifications as a group that all permit correct and non-animistic classification of object items. Since not enough data is available to support the contention made by Piaget that Use or Action justifications are more primitive than Movement, these too will be combined for the purposes of further analyses.

The next question to be answered concerns the existence and possible cause for plant errors, an issue which has never been systematically explored. Table Three indicates the frequency of occurrence of successful and non-successful classification of the two plant items in conjunction with the use of

particular justifications. In the first place, it should be noted, that indeed, a great many plant errors have been made. In fact, the children classify the plants as not-alive 46.9% of the time, as compared with only 21% of the time for object items. Thus the plant items are actually more difficult for the children to classify than are any of the other items. This is quite puzzling since a general animistic tendency would imply that children should classify plants as alive just as readily as they classify objects as alive. Furthermore, there is no apparent relationship between errors of classification for the plant items and the categories of justification used in the preceding analyses. In fact a great many of the errors for plants occur in conjunction with the use of Life Characteristic justifications, which is contrary to the relationship between object classification and their justifications.

At this point, several aspects of the data already examined suggest a reanalysis of the categories of justification. If it is assumed that children are very animistic at first, and that as their concept of life develops they become less animistic, then there exists the possibility that something in the process by which children learn that objects are not alive also leads them to classify plants as not alive, in this latter case, incorrectly. This hypothesis makes sense in terms of the fact that the children in this study are not, generally, very animistic, while a great many of them do misclassify the plants. The suggestion then, is that very young children will call objects, plants, and animals alive, and as they develop they restrict

Table III
Justifications and Errors- Plant Items

	Life Characteristics	Use Or Action	Movement	Locomotion	Spontaneous Movement	Logic or Pseudo Logic	No Answer	Total
				Flower				
Correct	31	6	5	0	2	4	3	51
Incorrect	22	1	5	1	3	8	5	45
				Tree				
Correct	33	6	4	0	2	2	4	51
Incorrect	21	2	6	2	3	2	9	45

life away from both objects and plants. The next question is why does this happen.

An explanation rather quickly presents itself. The previous analyses have suggested that Life Characteristics, Spontaneous Movement, and Locomotion justifications are all associated with very few object errors, but all with a great many plant errors (that is not to say that a definite pattern emerges). Perhaps, the crucial point in the child's learning that objects are not alive is when he learns to identify life strictly with animals at which point he judges things as alive or not alive in terms of the characteristics which he is aware of in animals. One would expect such characteristics as walking, feeling, thinking, wanting, seeing, having hands, face, eyes, etc. to be the most obvious characteristics of animals and the ones used by the children to distinguish animals from non-animals. However, it is quite apparent, that plants possess none of these characteristics --they don't walk, or talk, or see, or have faces. Therefore, it seems very possible that the child who has previously said that plants are alive because they give us shade, will now say that they are not alive because they can't see or walk. That is, the same growth which leads to a reduction in animism, also leads to a misclassification of plants. This would also suggest that children will again come to call plants alive when they begin to learn the crucial characteristics of living things, i.e. breathing, eating, drinking, water, growing, dying, giving birth or being born. At this point they would have a completely adequate concept of life.

The Life Characteristics justifications as originally defined included, then, both characteristics only applicable to animals and more general characteristics applicable to animals and plants. Therefore, in order to test the hypothesis, all of the justifications previously placed in this category were now reclassified as either Animal Characteristics of General Life Characteristic justifications. The latter included only the seven characteristics listed above, and the former included all others.

Table Four presents the relationship between the correct classification and incorrect classification of flower and tree in association with General Life Characteristics and Animal Characteristic justifications. There is an association in the predicted direction with many incorrect classifications given by children who use animal justifications and many correct classifications given by children who use General Life Characteristic justifications. Both of these distributions have chi-square values which exceed the .001 level of probability.

Thus, this analysis supports the contention that animal characteristic justifications are associated with misclassification of plants, while General Life Characteristic justifications are associated with the correct classification of plants.

The preceding analyses of the association between the use of certain justifications and the occurrence of certain kinds of classification errors have suggested that there are three important groups of justifications in terms of which the child learns to accurately distinguish between life and non-life: (1) Use or

Table IV

General Life Characteristic vs.
Animal Characteristic Justifications and Plant Errors

Flower		
	Animal	General Life
Correct	0	16
Incorrect	17	4

Tree		
	Animal	General Life
Correct	2	23
Incorrect	10	6

Action and Movement justifications are associated with object errors (animism); (2) Animal Characteristics including Spontaneous Movement and Locomotion are associated with few object errors but many plant errors, and (3) General Life Characteristic justifications are associated with few plant errors and few object errors. However, all of these analyses have been done in terms of associations between responses rather than in terms of groups of children who represent different stages in the development of the concept of life. A developmental model, similar to the original Piaget model, but more specific in certain areas has been suggested, but its usefulness of application not demonstrated. The next step in the analysis then is to use the model to define groups of children in terms of their error scores and to then predict and test differences in the use of different kinds of justifications by these groups of children.

The previous analyses have suggested that the children may be divided into three different groups, on the basis of the errors of classification of the items on the questionnaire which they make, and that these three groups of children should significantly differ in their use of the different combined categories of justifications. In the first group of children would be those who are animistic, who attribute life to inanimate objects. In the second group would be children who are not animistic, but who also deny life to plants. In the third group, would be children who have an entirely adequate concept of life and who classify both objects and plants correctly. The model suggests, as have all previous models, that none of the children will make

any significant number of errors in classifying the animal items (and, indeed, the data, which will be presented below, support this contention). Furthermore, it should be noted that this model is a developmental one, that it would be expected that children would begin in group one, move through group two to group three. As such, the three groups of children defined in this manner in the present study should differ in both age and cognitive development as measured by a standardized test.

A strict application of the model would suggest that children in the first group should classify all of the objects as alive, as well as all of the animals and plants. Children in the second group would be those who classify all of the objects as not alive, both of the plant items as not alive, and all of the animals as alive. Group Three children would be those who classify all objects as not alive, both plants and animals as alive. However, this kind of application of the model would prove most uneconomical, for very few of the children call all 14 objects alive, very few call all 14 not alive, and, in addition, some children call one of the plants alive and one not alive. Thus, it was decided to use criteria for the selection of the groups which would include all of the subjects in the study and that would still closely adhere to the model.

Children in Group One were defined as those who made more than two errors in classifying the objects, that is, called more than two objects alive and who were hence most animistic. Group Two children were defined as those who made two or less errors in the classification of the objects and who called at least one

plant not alive. Group Three children were defined as those who made less than two errors on the object items and who classified both plants as alive. These criteria are represented in the top portion of Table V.

Thus, the three groups of children defined to test hypotheses about the way in which children learn to distinguish life from non-life are objectively defined in terms of errors, although they are not pure representatives of the model. It would seem that this manner of definition of the groups should provide conservative tests of the hypotheses rather than positively biasing them. Furthermore, the decision to say that children who called only two objects alive are not animistic receives some support from previous research with college students and adults which indicates that even many subjects in these groups attribute life to one or two inanimate objects (Crannell, C., 1954; Dennis, W., 1953; 1957; Voeks, V., 1954).

The first interesting point to be made about the three groups of children so defined comes from the bottom portion of Table Five which indicates the mean number of errors actually made for the different kinds of items (plants, animals, and objects) by the groups of children selected in terms of the criteria indicated above. It is apparent that very few plant errors are made by children in Group I even though this group was not defined in terms of plant errors. This provides support for the notion that children who are more animistic classify plants as alive. The table also indicates that Group I children are, indeed, generally much more animistic than the

Table V

Groups of Children and Errors

Number of Child Errors for Inclusion in the Three Groups

	Objects	Animals	Plants
Group I	3+	Not Specified	Not Specified
Group II	0-2	Not Specified	1 or 2
Group III	0-2	Not Specified	0

Mean Number of Errors by Children in the Three Groups

	N	Objects	Animals	Plants
Group I	34	8.0	.1	.5
Group II	39	.3	.1	1.8
Group III	23	.6	0.0	0.0

children in the other two groups. These children classify an average of 8 (out of 14) inanimate objects alive, although a child had to classify only 3 of the objects as alive in order to be placed in this group. Finally, the table confirms the fact that animal errors are quite rare as is suggested by the model used here and those used in all previous studies.

The model, as presently specified makes some rather specific predictions concerning the use of different justifications by the three groups of children. The test of these predictions represent the central issue for the evaluation of the model in its present form. The first prediction to be derived from the model is that animistic children, Group I children, should give more Use or Action and Movement justifications (combined) than should children in Groups II or III who are not animistic. The second prediction is that Group II children, who have shown a reduction in animism, should show a significantly greater use of Animal Characteristic justifications (including Locomotion and Spontaneous Movement) than Group I children who are still animistic. The third prediction is that Group III children who deny life to objects but who classify plants as alive should show a significantly greater use of General Life Characteristic justifications than should Group II children who deny life to at least one plant.

Table Six shows the data and statistical tests relevant to the evaluation of these three hypotheses. In every case it was found that there were significant differences between the variances of the two groups to be compared, so the comparisons were

made by z-tests as suggested by Winer. The first test was that of the difference between Groups I and II in frequency of use of Use or Action and Movement justifications. The means do differ significantly in the predicted direction (9.94 for Group I children, 3.23 for Group II children, 4.04 for Group III children), so the hypothesis that animistic children use more Use or Action and Movement justifications is supported.

The second test was of the difference between Group I and II children in their use of all Animal Characteristic justifications. The difference is in the predicted direction (Group I uses an average of 5.24 of these justification, while Group II uses an average of 10.05) and significant at the .001 level. Thus, the hypotheses is supported that non-animistic children use more Animal Characteristic justifications than animistic children do.

The third test was of the difference between Groups II and III in their use of General Life Characteristic justifications. This difference, also, is in the predicted direction (Group II children use an average of 4.22 of these justifications as opposed to only 1.33 for Group II), and this difference is significant at less than the .02 level of probability. Thus, the hypothesis that children who are non-animistic and classify plants as correct use more General Life Characteristic justifications than children who are non-animistic but classify plants as not-alive also receives support.

Thus, all three hypotheses suggested by the model concerning the use of justifications by the three groups of children

Table VI

Mean Frequency of Use of Combined Categories
of Justifications by Three Groups of Children

Use or Action and Movement Justifications				
	N	Mean	S ²	p*
Group I	34	9.94	25.0	.001
Group II	39	3.23	12.3	
Group III	23	4.04	12.8	
Animal Characteristic Justifications (including Locomotion and Spontaneous Movement)				
	N	Mean	S ²	p*
Group I	34	5.24	11.7	.001
Group II	39	10.05	46.7	
Group III	23	6.26	26.5	
General Life Characteristic Justifications				
	N	Mean	S ²	p*
Group I	34	1.44	4.5	.015
Group II	39	1.33	8.7	
Group III	23	4.22	31.1	

* = z-test

receive statistical support. However, there is one further requirement of a model which describes the development of the child's concept of life, namely, that the groups of children so defined represent developmental stages. That is, the model was said to suggest that very young children are animistic, calling animals, plants, and objects alive; that children then progress and at some point restrict life to only animals; and that then at some final point in time they say that both plants and animals are alive, but not objects. These three stages of development are claimed to be represented by the three groups of children defined in terms of errors. It now remains to examine the relationship between these three groups and the stages which they are supposed to represent and two other measures of development, chronological age and intellectual development as measured by the Peabody Picture Vocabulary Test. That is, it would be expected that Group I children would be the youngest in terms of chronological age and the least mature mentally. Group III children should be the oldest and the most mature mentally. Group II children should be somewhere between the other two groups on both dimensions.

Table Seven indicates the mean mental and chronological ages of the three groups of subjects defined in terms of errors. It can be seen from the table that the three groups of children are not related to chronological age in the manner predicted by the model. Groups I and II are close to the same average age (about 81 months and 77 months respectively), with Group II actually being slightly younger, in contradiction to the pre-

Table VII
Chronological and Mental Ages of the
Three Groups of Children

	N	Mean Chronological Age (months)	S	
Group I	34	80.76	17.71	
Group II	39	76.90	22.58	
Group III	23	94.78	19.51	
	N	Mean Mental Age (months)	S	p*
Group I	34	66.67	22.14	
Group II	39	83.28	28.48	.01
Group III	23	116.74	28.55	.01

* = t-test

diction made from the model. On the other hand, Group III children are quite a bit older than either of the other two groups (about 95 months). Perhaps the explanation for this lack of consistency with the model is to be found in the age range of the children in the sample--there were no children younger than four years and none older than nine years eleven months. It is possible that the age at which most children are animistic is younger than four years and this could account for the fact that the data shows no difference between the two groups. This hypothesis receives some slight support from the fact that less than half of the thirty-two children in the four to six age range are in the animistic Group, so that if all children do pass through an animistic period, then it must occur for many below the age of four. Certainly this is a question to be answered by further research.

Table Seven indicates that the relationship between the three groups of children defined in terms of errors and mental age is, generally, as the prediction made from the model would suggest. That is, Group I children are much less developed in terms of mental age (about 67 months) than are Group II children (who average about 83 months), who are in turn less developed than are Group III children (about 117 months). The difference between Groups I and II and between Groups II and III are significant at the .01 level by t-test. Therefore, it appears that the model as presently specified does relate quite clearly to the child's level of mental development as measured in terms of a standardized test of intelligence.

The Second Administration of the Animistic Questionnaire

As indicated in the introductory chapter, there were two major reasons for readministering the animistic Questionnaire: (a) to get some indication of the reliability and stability of the stages defined in terms of children's responses on the first administration and (b) to provide a further check on the model's accuracy by evaluating predictions about the kinds of changes that take place in the children's responses over time. Two kinds of data will be presented to shed light on these two questions. A comparison of the children's classification into the three groups for both administrations will be made, with a chi-square analysis of the association between the two classifications. Then some specific hypotheses, derived from the model, concerning expected differences in use of justifications by children who move from one group to another from the first testing to the second will be made and tested.

As indicated in the previous chapter, 88 of the children in the original sample were readministered the animistic questionnaire after an interval of approximately six months. The protocols of all of these children were again divided into the three groups on the basis of their error scores, in exactly the same fashion as previously. However, one child who was retested could not be classified in terms of the model on the second administration. This subject classified all of the objects as alive and all of the animals and plants as not alive, and gave no justifications for any of these classifications (21 No Answers). It seems likely that she had confused the meaning of

alive and not alive, but there was no basis of support for this speculation since she gave no justifications and her protocol was thus excluded from further analysis.

Table Eight shows the frequencies of children in the three groups for the second administration as well as indicating the group they had been in the first time they answered the questionnaire. The chi-square value associated with this table exceeds the .001 level of confidence and hence indicates that, indeed, there is some stability in the children's responses. In fact, 53 of the children, or 60% were in the same groups for both administrations. However, of the 34 children who were in different groups for the two administrations, just as many were in a lower group the second time as were in a higher group than on the first administration. This apparent "regression" is very likely due in large part to chance variation (as is undoubtedly, some of the apparent progression). Thus, for a child who was previously classified in Groups II or III to be classified in Group I for the second administration, he had only to make three object errors instead of two. However, one of the useful aspects of the model is that it allows predictions to be made about children who were apparently misclassified as well as about children who make the more expected changes. That is not to say that chance variation is eliminated or controlled, but rather that some measure of its importance in terms of its impact on measurement of true changes is available. This should become clearer in the analyses to follow.

The first prediction to be derived from the model concerns

Table VIII

Children's Classification into Three Groups
for Two Administrations of the Animistic Questionnaire

		Classification for First Administration (groups)		
		I	II	III
Classification for Second Administration (groups)	I	20	8	4
	II	7	20	5
	III	3	7	13

children who progress from Stage I to Stages II or III. These children have moved from the animistic group (they made more than two object errors for the first administration) to a non-animistic group (they made two or less errors for the second administration). The model would therefore predict that these children should show an increase in the use of all Life Characteristic justifications (General Life, Animal Life, Locomotion, and Spontaneous Movement) from the first to the second administration. That is, the model suggests that the reduction of animism is accompanied by or is caused by an identification of life with animals and/or plants. Thus, the first prediction is that ten children who progressed from Group I to Groups II and III should show a significant increase in the use of these justifications. Furthermore, the model suggests, that a control group of children who remained in Group I for both administrations should not show a significant increase in the use of these justifications. These two hypotheses are tested in terms of the data in Table Nine. Both hypotheses are supported by the data. The children who advanced from Group I increased their use of all Life Characteristic justifications from a mean of 8.9 to a mean of 13.3- a difference significant at the .01 level. The control group, ten randomly selected subjects who did not advance from Group I, increased also, from a mean of 5.4 to a mean of 7.3, but this difference was not significant. Therefore, the prediction made by the model is supported in this case, since children who become less animistic do use significantly more Life Characteristic justifications than they did when they were more

Table IX

Use of All Life Characteristic Justifications
On Two Administrations of the Animistic
Questionnaire by Children Who Do and
Do Not Advance From Group I

	Group that advanced ^a			Group that did not ^a advance		
	Mean	Sd ²	p*	Mean	Sd ²	p*
Administra- tion I	8.9	21.5	.01	5.4	15.2	N.S.
Administra- tion II	13.3			7.3		

a = n=10 for both Groups

* = t-test

animistic. Furthermore, it is interesting to note, that this group of children who progressed, used more, on the average, Life Characteristic justifications than did the group who did not progress, even on the first administration of the questionnaire. This suggests that these children were more advanced on the first administration of the animistic questionnaire and might reasonably be expected to have been the ones to move to the more mature groups.

The second prediction to be made from the model concerns children who advanced from Group II on the first administration to Group III on the second administration. These children have changed from calling at least one of the plants not alive to classifying both of the plants as alive. The model would predict, therefore, that these children should show an increase in their use of General Life Characteristic justifications. That is the model suggests that movement from classifying plants as not alive to classifying them as alive is accompanied by or is caused by an increase in the use of General Life Characteristic justifications. Thus, the second prediction is that the nine children who advanced from Group II to Group III should show an increase in their use of General Life Characteristic justifications, while a control group, which was in Group II for both administrations should not show a significant increase in the use of these justifications. These two hypotheses are tested in Table Ten. In this case, the prediction is not clearly supported by statistical test. The children who advanced from Group II to Group III do show an increase in their use of General Life

Table X

Use of General Life Characteristic Justifications
on Two Administrations of the Animistic Question-
naire by Children who Advanced from Group II and
Children Who Did Not

	Group that Advanced ^a			Group that did not Advance		
	Mean	Sd ²	p ^b	Mean	Sd ²	p ^b
Administra- tion I	3.9	14.9	N.S. ^c	.8	13.2	N.S.
Administra- tion II	6.1			2.3		

a= n is 7 for both groups

b= t-test

c= approaches .05 level

Characteristics--from a mean of 3.9 to a mean of 6.1. However, this difference only approaches the .05 level of confidence. The control group also showed a non-significant increase, from a mean of .8 such justifications for the first administration to a mean of 2.3 of them for the second administration. Again, it is interesting to note that the control group's use of the justifications in question was much less frequent than the group who advanced even on the first administration of the questionnaire (a mean of 3.9 for the group that advanced vs. a mean of .8 for the control group). This again suggests that the children who showed the advancement by moving from one group to a more advanced group, were different at the time of the first administration from the children who remained the same. However, it certainly would seem advisable to further study the use of General Life Characteristic justifications for the most mature stage. More will be said about this in the final chapter.

The third prediction to be tested is indirectly derived from the model rather than directly implied by it, and concerns children who were in either Groups II or III for the first administration of the questionnaire and who "regressed" to Group I for the second administration. The prediction is not direct, since the model specifically accounts only for children who remain the same or progress. Thus, in terms of the model, children who appear to have regressed must have been misclassified for the first administration or, at least, they were not very securely in the stage which their classification into a group suggested. That is, it would seem that these children did not really belong

at the level where they were placed by the rules of definition of the three groups. In particular, these are children who appeared non-animistic on the first administration of the questionnaire and animistic for the second administration (they changed from classifying two or less objects as alive to classifying three or more objects as alive). Therefore, the model would suggest that these children probably used fewer of all of the Life Characteristic justifications on the first administration than did children who remained in the two more mature groups. Since the overall average frequency of use of all Life Characteristic justifications by children in Groups II and III was about eleven for the first administration, it was decided to test the hypothesis that the children who "regressed" used significantly fewer than ten of these justifications. The data for this comparison is shown in Table II, and in fact, the children who regressed do use fewer of these justifications than ten (a mean of about 6), and the difference is significant at the .01 level of confidence. Thus, the prediction that children who seem to move from being non-animistic to being animistic use fewer of all Life Characteristic justifications is supported by statistical test also. Thus, it would appear that a significant portion of the variation of children's classification into different stages on subsequent administration of the questionnaire can be accounted for in terms of their use of justifications as a measure of the extent to which they appropriately belonged in the original stage as assigned.

Table XI.

Use of Movement and Use or Action Justifications
By Children Who Regressed From the First Adminis-
tration To the Second Into Group I

Mean	s^2	N	p^*_b
6.0	30.0	12	.01

* = t-test

b = Compared with 10, less than the average ones of these justification by all Group II and III children on the first administration.

The Explanations of the Demonstrations

There were several questions to be answered in the analysis of the children's explanations of the mechanical demonstrations. The most general of these concerns the existence of precausal thought in the young child. Piaget indicates that, generally, children younger than seven or eight years old give non-mechanical explanations for natural events. In particular he describes the nine precausal thought forms which are explained in detail below and indicates that pre-causal thought generally is characterized by (a) inattention to the detail of how things happen, (b) disregard for the temporal sequence of events, (c) disregard of the necessity for spatial contact between objects for the transfer of energy. Four subsequent studies have used mechanical demonstrations to be explained by children and have failed to elicit pre-causal responses, or at least have failed to find them in their data. However, these studies have often employed subjects who were too old in terms of Piaget's implications about precausal thought, or, they have used subjects of appropriate age but who were well above average in mental ability and who might therefore have been expected to have already progressed beyond precausality.

In view of these issues, the first question to be answered in the present analysis is whether or not the children's explanations for the mechanical demonstrations can be reliably classified in terms of Piaget's descriptions of the categories of child explanation. It is possible, of course, that many of the explanations will fit reliably into his categories, but that

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others may not. That is, it may be that the nine forms which Piaget describes are not really an exhaustive and complete description of pre-causal thought. It may be that the forms which children give are related to the demonstration which they are asked to explain. Therefore, the second question to be answered by the analysis of the data concerns the relationship of the kinds of explanations given to the demonstration to be explained. This should give some indication as to the comprehensiveness of Piaget's nine pre-causal thought forms. Finally, if it can be shown that children do give pre-causal explanations, then it should be possible to relate the decline of their use and the rise of mechanical-logical demonstrations to both chronological age and mental development.

In view of the above issues, the first step in the analysis of the children's explanations was the writing of a set of coding instructions to be used in classifying the responses. The nine categories of pre-causal thought described by Piaget are as follows: Psychological Causality (some motive of the experimenter, or of the subjects, or of God, made the event happen), Magical Causality (a gesture of the experimenter or of the subject made the event occur), Participation (one object or force acted at a distance to cause the event), Phenomenism (an object or condition with no causal connection to the event but occurring at the same time is considered to be the cause of the event), Animism (the will or intent of an inanimate object is considered to be the cause of an event), Dynamism (an inherent force, strength, or power of the object, often referred to as

its size or weight, is said to cause the event), Artificialism (people or God made the object or event in such a way that it would happen), Moralism (the event is supposed to happen as it does), and Finalism (the event occurred so that its effect would come about).

The author made a set of coding instructions based upon these descriptions of the categories and his experience in administering the demonstrations. This appears in Appendix B together with examples drawn from the explanations provided by the children, which were also given to the other coders. Lists were typed of the children's explanations for the eight demonstrations. Each list contained the responses to only one of the demonstrations, so that the rating of a particular child's explanations were made independently of one another. The children's responses were assigned a random and different order for each of the eight demonstrations, and the responses were given a new number so that the associations between the original subject numbers and age would not effect the rating.

The experimenter rated all of the responses to each of the eight demonstrations. In several cases, where there had been an extended dialogue with the child, the explanations contained responses which suggested more than one coding. In such cases, the experimenter rated the response which came first, or the one most emphasized by the child and underlined that portion of the total response so that the other raters would focus upon the same verbalization. Two other raters then independently rated the responses to the first four demonstrations and another two raters

the last four.

The first question to be answered, then, concerns the ability of the three raters to reliably classify the responses in terms of Piaget's nine categories of pre-causal thought and his description of mechanical-logical thought. The data relevant to answering this question appears in Table Twelve.

Table Twelve indicates that all three of the raters agree on the rating of a particular response about 60% of the time, on the average, with a range from 41.5% to 77.5% for the eight demonstrations. The fact that over 60% of the children's explanations can be independently categorized in the same way by three different raters suggests that many of the children's responses are indeed, unambiguously described in terms of Piaget's system. This still leaves a great many responses which are not precisely described by the system. The experimenter's own experience in classifying the explanations suggested that this ambiguity was indeed present in the responses, themselves, rather than simply being an effect of the rater's misunderstanding or confusion about the categories. On the other hand, most of these responses were clearly not mechanical in terms of the three characteristics indicated above. Thus, they appeared pre-causal in the general sense, but did not seem to fit very well in any of Piaget's nine particular categories. This contention is supported by the fact that the three raters agree more than 80% of the time in classifying the explanations as mechanical-logical vs. pre-causal thought in general. That is, there was a great deal more agreement about whether or not a response was pre-causal or mechanical

Table XII

Three Rater's Agreement In Classification Of
 Children's Explanations Into Piaget's Nine
 Categories of Precausal Thought and
 Mechanical-Logical Thought

Demonstration #	% All 3 Agree	% 2/3 Agree
One	49.0	92.8
Two	41.5	92.6
Three	67.0	91.2
Four	77.5	96.6
Five	54.3	86.9
Six	64.5	91.4
Seven	69.4	88.8
Eight	62.4	89.3
Total	60.1	91.1

than about the specific precausal category into which the explanation might fit.

The next question to be answered in the analysis concerns the distribution of the various kinds of precausal responses in terms of the eight demonstrations to be explained. If Piaget's nine categories of pre-causal thought are comprehensive as he suggests, then all of the different types should be given for each of the demonstrations and there should be few instances where one demonstration calls forth a great many of one type of explanation or where a demonstration calls forth very few of one type of explanation.

In over 90% of the cases, at least two out of three raters agreed as to the exact classification of the explanations. These agreements were used to obtain a final classification of the explanations in terms of Piaget's system. The frequencies with which particular categories of explanations occur for each of the eight demonstrations is indicated in Table Thirteen.

An examination of Table Thirteen indicates that indeed, the categories of explanations do depend on the particular demonstration to be explained. For instance, phenomenism appears as a response 32 times for one of the demonstrations and less than ten times for six others. Participation appears 23 times for one demonstration and less than ten times for all of the others. Magic occurs 24 times for one demonstration and not at all for any of the other demonstrations. Thus, it would appear that particular kinds of events tend to call forth particular categories of precausal thought. Moreover, many of the cate-

gories occur very seldom for any of the demonstrations--Animism, finalism, artificialism, and moralism occur less than five times for all of the demonstrations (there are a total of 26 of these explanations out of 436 precausal explanations and 768 explanations all together). Thus, these are rare for these eight mechanical demonstrations, although they apparently appeared fairly frequently when Piaget questioned children about natural events. This gives further support to the suggestion that the forms of precausal thought are dependent on the question asked of the child.

In view of the evidence presented that there is no great reliability in classifying the explanations into particular pre-causal thought forms and the evidence suggesting that these nine forms described by Piaget are perhaps not exclusive anyway, it seemed most reasonable to combine all of the explanations categorized as precausal into one category for further analysis. As indicated above, in over 80% of the cases all three raters agreed in making this distinction between precausal explanations and mechanical-logical explanations. The two questions that remain to be answered, then, using these combined ratings, concern the relationship between pre-causal thought and age and intellectual development.

Piaget contended that precausal thought generally disappears by the age of seven or eight. Table Fourteen indicates the mean number of pre-causal and mechanical-logical responses given by children of the three different age groups represented in the sample. The mean number of pre-causal responses declines

from 6.53 in the four to six year old group to 3.56 precausal responses in the eight to ten year old group. The number of mechanical responses, increases from a mean of .66 in the four to six year old group to a mean of 4.09 in the eight to ten year old group. The differences in mean use of both of these kinds of explanations are significant in the predicted directions for all three age groups. Thus, the data support the contention that pre-causal thought does decrease with increasing age and mechanical explanations increase. Children at the eight to ten year old level are still giving an average of over three pre-causal responses, so some children do continue to use them after the age of seven. This is not too startling however, for Piaget himself indicates that there are many exceptions to the general age trends.

The final question to be answered concerns the relationship of precausal thought to more general intellectual development as measured by a standard instrument. Since it has already been shown that the use of this kind of explanation is highly related to age, it would be predicted, that considering children of the same age, those who are above average in intellectual development should use significantly fewer precausal explanations than children who are below average in intellectual development. In order to test this hypothesis, the children in each of the three age groups were subdivided into high, medium, and low I.Q. groups on the basis of their scores on the Peabody Picture Vocabulary Test. The mean number of precausal responses given by these groups of children are shown in Table Fifteen. The

Table XIV

Frequency Of Precausal and Mechanical
Explanation by Children of Three Age Levels

Mean Number of Precausal Explanations Given by
Children of three age Levels

	N	Mean	S^2	Z	p
4-6 years	32	6.53	1.13	3.68	.001
6-8 years	32	5.31	3.30	4.03	.001
8-10 years	32	3.56	2.72		

Mean Number of Mechanical-logical Explanations
given by Children of Three Age Levels

	N	Mean	S^2	Z	p
4-6 years	32	.66	.88	4.40	.001
6-8 years	32	2.22	3.14	4.44	.001
8-10 years	32	4.09	3.25		

data indicate that for the 4-6 year olds, there is no significant difference in the use of precausal explanations between children of high and low intellectual development and, in fact, the more advanced children give slightly greater numbers of such responses, on the average. This is not too surprising, since in this age group, almost all of the children give a great many precausal responses. For the 6-8 year old group, there is a significant difference in the predicted direction-- the less advanced children give a mean of 6.50 precausal responses while the more advanced give a mean of only 4.50. This difference is significant at the .01 level. For the 8-10 year old group, there is also a significant difference (at the .05 level), in the predicted direction. The less advanced children give an average of 4.00 precausal responses, while the above average children give a mean of only 2.70 such responses. Therefore, the analysis supports the notion that precausal thought is closely related to general cognitive development as measured by a standardized test. Finally, it should be noted, in view of the preceding analyses, that both chronological age and I.Q. independently effect the variance of frequency of precausal explanations.

The Causal Learning Task

As indicated in the introduction Piaget describes diffuse animism as a pervasive schema of child thought. As such it is an organizer of the child's perception and description of reality, and is not directly modifiable by events in the outside

Table XV

Mean Frequency of Precausal Explanations
Given By Children At Three I.Q. Levels, By Age Groups

4 - 6 year old group				
I.Q. level	N	Mean	S ²	p*
Low	10	6.20	1.29	
Middle	12	6.75		-
High	10	6.60	.93	
6 - 8 year old group				
I.Q. level	N	Mean	S ²	p*
Low	10	6.50	1.39	
Middle	12	5.00		.01
High	10	4.50	3.17	
8 - 10 year old group				
I.Q. level	N	Mean	S ²	p*
Low	10	4.00	2.22	
Middle	12	3.91		.05
High	10	2.70	2.77	

* = t-test

world. Therefore, the implication has been drawn that children who think precausally will have difficulty in learning a causal relationship even in the face of directly relevant experience. That is, a child who thinks precausally might not be able to learn a causal relationship which demanded that he make a specific connection between an antecedent event (a cause) and a subsequent event (an effect), even when an effort is made to isolate that cause for him. As suggested in earlier sections, children are able to connect almost any concurrent condition with a subsequent event, disregarding the temporal sequence, the need for spatial contact between objects for the transfer of energy, and, in general, ignoring the details of the event.

The present study attempted to provide a situation where the child received several experiences with a particular cause-effect sequence, with the hypothesis that children who gave pre-causal explanations for the event would be those who failed to learn from it. Thus, the children were given eight initial trials to learn that the eventual fate of the ball depended upon its height on the starting side of the chute, and then four runs with the same ball to show that the distance traveled by the ball was directly related to its height on the starting side. It was hypothesized that children who failed to learn the relationship, i.e. who failed to successfully learn to predict the fate of the ball given its initial position, would also be the children to give pre-causal explanations for the ball's behavior.

In fact, 26 of the 88 children in the sample did fail to

learn to predict whether or not the ball would go off the chute (three out of four correct predictions on the four trials after the demonstration of the relationship between starting point traveled and height on the other side, or four consecutive trials before it). All 62 of the children who did learn the relationship gave an explanation which related the ball's behavior to its height on the starting side of the chute. Only four of the 26 children who failed to learn the relationship gave these kinds of responses. The other 22 who failed gave explanations very similar in form to the ones encountered previously for the mechanical demonstrations. All of the responses given by children who failed to learn the relationship are shown in Table Sixteen. It is readily apparent that the explanations given by the children who failed to learn the relationship are precausal in the sense used by Piaget and used in the earlier analyses in this paper. Many of them are easily categorized into the precausal forms described by Piaget (the categorizations indicated were made by the author).

Table Seventeen indicates the frequencies of success and failure at learning the cause-effect relationship and pre-causal or mechanical explanation for the event. The chi-square value of this distribution exceeds the .001 level of probability. Thus, the original hypothesis, that failure to learn the correct cause-effect relationship would be associated with precausal explanation is supported by statistical test.

Table Seventeen also shows the distribution of success and failure to learn the relationship for the three age groups of

Table XVI

Explanations For the Causal Learning Task By
Children Who Did Not Learn the Relationship

- #9 The chute makes it. (Dynamic)
- #6 Some are too big, some are too small. (Dynamic)
- #23 Either they're big or little. (Dynamic)
- #29 When that (joint) goes up, it won't go off; when that (nail) goes down, it will go off. (Phenomenistic)
- #28 Because it didn't want to. (Animistic)
- #12 If way up high will go over; if way down low, won't go off- it gets more balance and can stay better. (mechanical)
- #11 I guess because of the weight it holds. (Dynamic)
- #14 Because the bounce. (? Precausal)
- #13 Because it was small, it made it go over. (Dynamic)
- #26 Because some balls are slow and some are fast; some are big and some are little. (Dynamic)
- #25 Because they're heavy and not heavy and real strong and not strong. (Dynamic)
- #30 Because that thing there (the hole in the chute) made it come up and go down. (Phenomenistic)
- #21 Air didn't get windy and didn't blow it off. When the wind don't blow it, it doesn't go down. (Participation)
- #24 Because you put it up there. Because you. Because you put it there. (Psychological)
- #22 It's supposed to. (moralism)
- #10 I don't know, but some of them are heavy. (Dynamic)
- #34 It doesn't have much air in it sometimes. (participation)
- #47 If you put it up high it will roll off. (mechanical)
- #48 It was heavier sometimes. (Dynamic)
- #50 Because it wants to sometimes. (Animistic)
- #52 Some people let the ball go and it won't roll off. (Psychol.)
- #72 You didn't let it roll so fast. (Psychological)
- #75 If it's big or not big, cause it can't go faster. (Dynamic)
- #79 Cause you put it up high. If you put em low they stay on. (mechanical)
- #57 Where you start it. (mechanical)
- #62 Too heavy, I guess. (Dynamic)

Table XVII

Age Level and Explanations Of Children
Who Learn and Do Not Learn the Relationship

Frequency of Children who Learn and Fail to Learn the
Causal Relationship, by Age Level

	Fail	Learn	
4-6 year olds	16	14	
6-8 year olds	8	22	
8-10 year olds	2	26	$\chi^2 = 14.81$ $p = .001$

Frequency of Children who Learn and Fail to Learn the
Causal Relationship, by Explanation (Precausal-mechanical)

	Fail	Learn	
Mechanical	4	62	
Precausal	22	0	$\chi^2 = 71.99$ $p = .001$

children in the study. Success and failure is highly related to age, since sixteen of the thirty children in the four to six year old group fail to learn the relationship (and fourteen of these give a precausal explanation), while eight of the thirty in the six to eight year old group fail and only two of the twenty-eight children in the eight to ten year old group fail. The chi-square value associated with this distribution exceeds the .001 level of probability. Thus, success and failure on the causal learning task is highly related to age, just as the disappearance of precausal thought was shown to be in the previous section.

The Relationship between Animistic Thinking and Precausality

As indicated in the introductory chapter, Piaget considers precausal thought and systematic animism to be intimately related. In fact, he maintains that children give precausal responses because they cannot distinguish between life and non-life on any level. He indicates that when children begin to know that objects are not alive, they begin to search for mechanical explanations for physical events. One purpose of the present study was to obtain measures of systematic and diffuse animism from the same children, so that an empirical test could be made of Piaget's theoretical explanation.

Thus, Piaget's theory suggests that animistic children should give significantly fewer mechanical explanations than non-animistic children. In the present study, this would suggest that children in Group I (children who made more than two

errors in classifying objects as alive or not alive) should give significantly fewer mechanical explanations than children in Groups II and III (who misclassify two or fewer objects). Table Eighteen shows the mean frequency of mechanical responses to the demonstrations given by children in Group I and those in Groups II and III, by age. The data indicate that there is almost no difference in the mean number of mechanical explanations given by animistic and non-animistic children for the four to six and six to eight year old groups. There is a difference, in the predicted direction for the eight to ten year old group, but this difference does not approach significance. Thus, these tests do not support Piaget's hypothesis that animistic children should give significantly fewer mechanical explanations than non-animistic children.

However, since the animistic group was defined in terms of requiring only more than two object classification errors, it is possible to argue that the above tests are too conservative, since some children included in the animistic group are really not very animistic. Therefore, it was decided to calculate correlation coefficients for the relationship between number of inanimate objects called alive and the number of mechanical responses given. It would be predicted, on the basis of Piaget's notions, that there would be a significant negative correlation between the two variables--that a high number of objects called alive should be associated with a small number of mechanical responses. Table Nineteen indicates these correlation coefficients for the three age groups of children and for all subjects.

Table XVIII

Use Of Mechanical Explanations By Children
 In Group I and In Groups II & III,
 By Three Age Levels

	N	Mean	S ²	N	Mean	S ²	p*
4-6 years	12	.75		20	.60		—
6-8 years	14	2.07	3.76	18	2.33	2.82	N.S.
8-10 years	8	3.50	3.14	24	4.29	3.26	N.S.

Table XIX

Spearman Correlations Between Number Of Objects
Called Alive and Number of Mechanical
Explanations--By Age Levels

	N	r	.05 level
4-6 year olds	32	.18	.35
6-8 year olds	32	-.10	.35
8-10 year olds	32	-.25	.35
All subjects	96	-.17	.19

The correlation for the four to six year old group is positive, for the six to eight and eight to ten year old groups negative, but not significant. For all subjects, the correlation coefficient is $-.17$, which approaches significance at the $.05$ level, but which is none-the-less indicative of a very weak relationship. Thus, the present study provides no evidence to support Piaget's contention that systematic animism and precausality are related.

Chapter IV

DISCUSSION AND CONCLUSIONS

Systematic Animism

The present study of systematic animism was based on the assumptions that (a) previous studies employed a model for describing children's development of the concept of life which was incomplete in several respects and (b) by a more thorough and systematic analysis of the data obtained from a questionnaire on animism a more complete model could be specified which would more precisely describe the development of the concept of life. In particular, the present study attempted to specify a model that would (a) represent stages in the development of the life concept, objectively and precisely defined, differing both in the focus of errors and in the kinds of justifications given for life-nonlife classifications, (b) clarify the justifications used by non-animistic as well as animistic children, (c) account for errors about plants and their eventual decline, (d) provide specific predictions about the kinds of changes in responses that children should show as they move from one group to another over time, and (e) relate to other developmental indices such as chronological and mental age.

The first major result of the study was, then, the specification and evaluation of a model in terms of the above ob-

jectives. Thus, the present model suggests that children are initially animistic--they attribute life to animals, plants and objects and they tend to give Use or Action and Movement justifications for their classifications. As development proceeds, children seem to learn to identify life with animals--they give Animal Characteristic justifications (which include Locomotion and Spontaneous Movement) and they restrict life to animals only. Plants as well as objects are classified as not alive. Finally, a stage is reached when the children reinclude plants in their concept of life and at this time they tend to give General Life Characteristic justifications, crucial to an accurate definition of life. In order to test the application of this model, groups of children were defined in terms of their error patterns so as to represent the three stages defined by the model.

The model requires differential use of justifications by groups of children defined by error patterns. Thus, the animistic children should offer more Use or Action and Movement justifications than non-animistic children. Conversely, non-animistic children should use more Animal Characteristic justifications than do animistic children. Children who are most clearly non-animistic - classify objects and plants correctly - should use more General Life Characteristic justifications than children who classify plants as not alive. Each of these implications was tested for statistical significance with the three groups of children defined in this study, and all three hypotheses were supported. It should be noted that the children in the

most mature stage actually give a mean of only about four General Life Characteristic justifications, significantly higher than the other groups, but not frequent enough to be considered an essential justification for errorless classifications. The limited use of such higher order explanations may be due in part to the restricted age range of the sample and should be evaluated further with older children. However, it is also possible that this category of justification will never be used for a majority of the items on the questionnaire by most children because, for all of the items besides the plant item, it is unnecessary. That is, all of the object items may be correctly classified in terms of animal characteristics, but the plant items require the use of General Life Characteristic justification in order to be correctly classified by non-animistic children. It may be, then, that a child must understand the crucial characteristics of life, but he may still apply them only when necessary or just infrequently.

The three groups of children specified in terms of the model were not incrementally related to chronological age as the model would predict. The children chosen to represent Stage II were essentially of equivalent ages to those representing Stage I. Stage III children were indeed older than the other two groups. It is, of course, possible that the stages of development are simply not very precisely related to chronological age, but rather reflect levels of cognitive development. In the present study, this appeared to be the case, for there were large and significant differences in Mental Age (derived from

the children's scores on the Peabody Picture Vocabulary Test) in accordance with the order of predictions. That is, Group I children were the least mature in terms of Mental Age (mean of 5 years 6 months), Group II children were intermediate in mental maturity (mean Mental Age of about seven years), and Group III children were the most mature (about 9 years 9 months). Thus, there is a good deal of support for the contention that the stages of the development of the concept of life, as defined in the present study, are clearly related to general cognitive development.

Finally, the model was used to make predictions about children who apparently moved from one "stage" to another over time in terms of changes in their use of justifications. It was found that about 60% of the children who were retested after a six month interval were in the same group as they had been for the first administration. This suggested that the groups as defined do represent fairly stable patterns of thought in the children. It was predicted that children whose responses resulted in a shift of stage assignment from an animistic group to a non-animistic group would show significant increase in their use of all Life Characteristic justifications. This hypothesis was supported by statistical test. It was also predicted that children reassigned from a group that was non-animistic but classified plants as not alive to a group that correctly classified all types of items would show an increase in General Life Characteristic justifications. This hypothesis was not sufficiently supported by the data. Therefore, the conclusion is again

reached that the use of General Life Characteristics as justifications must be studied further.

The model of systemic animism as developed in this study is clearly based upon and related to the models used in earlier studies. All other authors have suggested that Use or Action and Movement are more primitive justifications and are associated with animistic classification of objects. The present study confirms this finding. On the other hand, it was contended by Piaget and the Russell and Dennis group that Use or Action justifications are more primitive than Movement. The data in the present study are inconclusive on this point--future studies should include younger subjects and more motionless but useful and motionless but not-useful objects. It should be noted that this suggestion would make good theoretical sense in terms of the model specified here, since movement is probably the most salient and first recognized (by children) characteristic of animals, and the model suggests that children first come to restrict the life concept when they identify life with animals and their characteristics.

Laurendeau and Pinard's suggestion that anthropomorphic justifications are primitive seems quite unjustified in view of the data presented in the present study. This category of justification is associated with a minimal number of incorrect classifications of objects (about 3.2%). In fact, in the present model these justifications are assumed to be the most mature and vital to the reduction of animism.

Thus, the model specified in the present study not only is

more precise and better defined in terms of the available data than were previous models, but also it has the added advantage of bringing more clarity to the description of how children learn to distinguish life from non-life. That is, the model indicates that the first crucial step in the reduction of animism is the equation of life with animals and their characteristics (with perhaps movement constituting the first characteristics of animals to be noted). This identification leads to the exclusion of plants along with the reduction of animism with regard to inanimate objects. Thus, there is a more logical progression to the description of the process than with earlier studies.

For future work, in addition to the suggestions that older and younger subjects be studied, one of the prime needs is to study the development of the life concept longitudinally. The developmental changes implied by this model (or any of the previous ones, for that matter) can not be conclusively evaluated in terms of cross sectional analysis. The present study has indicated that children can be objectively divided into groups based upon certain specific criteria and these groups differ in certain ways on other dimensions than the ones by which they were selected. The fact that one of these dimensions is Mental Age suggests that the stages defined are related to general cognitive development, but it does not provide sufficient knowledge about the developmental course of the concept of life in individual children.

Precausality

The present study of precausality was made on the assumptions that (a) previous studies had failed to discover pre-causal explanations by children in relation to mechanical demonstrations because of methodological deficiencies and that (b) only a study designed specifically in terms of Piaget's original description and theories about precausality could provide conclusive evidence on the matter. The study was also designed to investigate whether or not Piaget's particular categories of pre-causal thought have universal and exhaustive application. That is, Piaget delineated the nine pre-causal categories in terms of children's explanations for natural events. He did not indicate the relative frequencies of category occurrence, nor did he report whether or not particular categories were associated most frequently with particular events to be explained. It was thought possible, then, that some explanations might be specific to some particular kinds of events and that some categories occur only very infrequently.

The data from the present study indicate quite clearly that children do give pre-causal explanations for mechanical demonstrations involving movement or apparent movement. Over 60% of the explanations given by children were independently classified in the same category of pre-causal thought or mechanical-logical thought by three raters. And, for children in the four to six age group, the average number of pre-causal responses is 6.53 out of a total of eight possible responses.

However, the data also suggest rather strongly that Piaget's nine categories of precausal thought are not exhaustive or entirely relevant. That is, some of the forms were extremely rarely found as explanations for the demonstration in this study, and for most of the forms which did occur fairly frequently, there seemed to be some relationship between the event to be explained and the frequencies of those forms. Thus, it appears that Piaget's nine categories of precausal thought are not universal nor completely applicable to all events and situations. But, it does appear that his general description of precausal thought--i.e. explanations which show lack of attention to the details of how an event occurs, disregard for temporal sequence and the necessary contact between objects for the transfer of energy--is quite valid for describing young children's explanations.

It is quite interesting to note that the four precausal forms which occur with greater than 10% frequency (considering only the precausal forms) are all the non-specific forms wherein the child's greatest error is in not specifying completely or in enough detail the causal sequence. That is, Psychological Causality, Phenomenism, Participation and Dynamic Causality, are all non-specific forms wherein the children give incomplete explanations. The other forms, Animism, Finalism, Magic, Artificialism, and Moralism, are much more specific in attributing causality incorrectly or inappropriately, and all of these forms occur much less frequently. In other words, when the child says, "You did it, you made it happen," he is said to

have given a psychological explanation. Actually, his chief fault lies in not specifying how the experimenter made the event happen, even though the child was questioned further in an attempt to elicit this information. It seems that in the pre-causal period the child is simply content to identify a part of the causal sequence and not to relate it sequentially, nor spatially to the final outcome. It is literally true that the experimenter ^{ARGUABLE} made the events happen, but children seemed to be unable and uninterested in explaining how the experimenter did this for a particular event. The same kind of reasoning applies to phenomenistic explanations. The child who said that the black stuff (the carbon) on the outside of the test tube made the cork pop was responding specifically to a part of the event that he saw. His ability to think that the black stuff was the cause of the event indicated little knowledge of the rules by which energy is transferred by spatial contact of objects (or gases) in motion. Thus, this data also suggests that it is the child's lack of attention to detail and sequence and contact which constitute the essential nature of his pre-causal explanation. However, it should also be noted that, as in the case of the magic trick, children can be pushed into a position where they will give the more directly incorrect explanations. This might be the reason why Piaget apparently found so many of all the forms, for the movement of planets, etc. is probably much more abstruse to the child than is the movement of a balloon. Thus, it is possible that children begin to give mechanical ex-

planations for familiar events while at the same time they are still giving precausal explanations for more remote happenings. They are much more likely to learn to attend to the details of an event which is close to them in time and space than for an event whose details are obscured by distance.

The present study indicates quite clearly that precausal thought is related to chronological age, that by the time children are in the 8-10 year old group, less than half of their responses are precausal. Furthermore, within the two older age groups (6 to 8 and 8 to 10) children of below average intellectual development as measured by the Peabody Picture Vocabulary Test give significantly more precausal responses than children of above average ability. This suggests that indeed, precausal thinking's decline is closely dependent on cognitive maturity.

One issue which needs some further clarification is the actual nature of the mechanical responses given by the children. It is certainly not true, as can be ascertained from an examination of the sample responses in Appendix C, that all of the mechanical explanations are correct. In fact, from a strictly scientific point of view, they seldom are. But, when the child says that the card moves away without the block because the block wanted to stay where it was, or, because the experimenter didn't touch the block, he is not providing information about differences in the physical environment which contribute to the block's staying still on this occasion, when before it moved with the card. On the other hand, when the child says that the

block stayed in the same place because the card is too slippery to keep it with it, or because the card is going faster than it did before, he is paying attention to and representing to himself details that are causally relevant, even though he knows nothing about inertia. Similarly, the child who thinks that the ball can come from the experimenter's pocket back into the cup, invisibly and without physical contact with a causal agent, is not yet showing that he understands mechanical movement and the necessity for spatial contact for the transfer of energy. The child who can represent to himself, the fact that when the box spins that at least for a moment, the penny is beneath it and is not held up by it, and then can hypothesize that the box has already moved on before the penny has a chance to fall, is showing a great attention to physical details and the changing relations between objects in a time sequence, even though he is not actually correct and knows nothing about acceleration and centrifugal force. The child who says that the string holds the penny in, almost never considers the details of how this might happen, even when pressed to do so, but rather seems to simply be making the verbal connection, "string-holds things--holds penny in." It seems fairly likely, then, that adults who are unsophisticated in concepts of physics might well give responses quite like the primitive causality of the older children. It is highly doubtful that they would give precausal responses. However, this might be a good objective for another study.

Certainly, the present study must be considered only a re-introduction to the study of precausal thought. It has de-

monstrated that children do use explanations which violate some of the fundamental rules of adult causal reasoning. On the other hand, there are a number of other factors which need further study. Thus, it would be most helpful to make a thorough study of whether or not the kinds of explanations children give are related specifically to different kinds of events whose differences may be specified on certain dimensions--length of causal sequence, familiarity, etc. might be important variables.

Causal Learning

This portion of the present study was based on the implication from Piaget's work that precausality represents a schema of thought in the child and as such that it is not directly responsive to reality. Thus, Piaget suggests that the child is able to connect almost any aspect of a situation as the cause of almost any outcome, and that then, the child will see no need to modify that explanation even in the face of contradictory or other corrective experience. The present study attempted to assess this hypothesis by designing a situation in which the child was asked to learn to make a correct prediction of an outcome such that the factor influencing that outcome was available to his perception and such that other hypotheses would be contradicted by repeated experience with the different outcomes. Thus, it was assumed that many children would relate the ball's eventual fate on the chute to its color and size. However both size balls and both colors stayed on and went off the chute on

different occasions. Children who did not learn the relationship after eight trials were given experience intended to be directly relevant to the causal relationship--that is, they were shown that the distance which a ball traveled up the chute depended on its height on the starting side.

It was found that, indeed, many of the children did fail to learn the relationship even after the special demonstration of the relationship between height on one side and height on the other. The great majority of these children (22 out of 26) gave precausal responses very similar to those given by the same children for the mechanical demonstrations six months previously. All of the children who learned the relationship gave responses mentioning the height of the ball on the starting side.

Thus, the present data do suggest quite strongly that there is a relationship between being able to correctly isolate the cause of an event and precausal or mechanical explanations for that event. Furthermore, success and failure at the task, as well as precausal explanations for it, were highly related to age. However, there are some obvious shortcomings in the present study which suggest the need for further study of this issue. In the first place, the children were not asked for an initial explanation for the ball's fate on the first run. Thus, there is no way of determining if indeed, the children who learned the relationship initially gave different explanations for the event than children who did not learn the event. This would certainly be the prediction based on Piaget's theoretical

notions, but there is no data available to support this contention. It may be that children who eventually learn the relationship begin by referring to the ball's size or color also, but then modify their response when they see the contradiction of their hypothesis and are lead to perceive the true cause of the event. If this is true, it would have implications for the nature of precausal thought in general. For this would suggest that some of the children who appear pre-causal can be pushed to produce more mature responses. There is also some question as to the relevancy of the experience which was intended to give the children direct experience with the causal relationship which effected the ball's progress. That is, very few of the children who had not learned the relationship by the end of the eight initial trials showed learning after the experience with the one ball in isolation. This may mean that children who had not learned the relationship after the initial trials were truly precausal thinkers and could not learn from it. On the other hand, it might also mean that the experience was not as relevant or as helpful as it was intended to be. Future studies should attempt to explore other ways of providing experience that will thoroughly test the effect of the precausal explanation upon perception and learning of cause-effect relationships.

Furthermore, any future studies should attempt to explore the relationship between success and failure on this kind of task and precausal explanation and more general cognitive development. It would be particularly interesting to see the relationship between the children's performance in this kind of

situation and some other measure of perceptual development. The present task was designed so that the perception of the causally relevant condition should have been very easily discriminated, but the possibility exists, of course, that it was an inability to perceive the difference which made some children fail to learn the relationship and that their precausal explanations were simply made up in order to hide their failure.

Systematic Animism and Precausality

The present study was unable to discover any support for Piaget's contention that precausality and systematic animism are closely related. That is, there was no indication of any strong relationship between precausal responses and the animistic classification of objects. Piaget suggested that children give precausal responses because they do not distinguish between animal motion and objects in motion. The fact that this contention is not supported in the present study adds some support to the contention made above that precausal thinking on the part of most children reflects inattention to detail, confusion about temporal sequence and lack of understanding of the need for spatial contact for energy transfer, i.e., incomplete explanations and the inability to see that their explanations are incomplete rather than directly attributing causality to supraphysical aspects of a situation--will, intention, magic, etc. If this is true, then it may well

be that precausality has its roots more deeply in the child's inability to correctly isolate details and sequences perceptually, and his inability to reflect critically on his own thoughts and represent reality to himself, rather than in a confusion between life and non-life.

The present study is by no means conclusive on this issue, however. For one thing, it is possible that there is a considerable lag between the decline of animistic attribution of life to objects and the decline of precausal explanations. Such a lag could account for the lack of relationship found in the present study.

APPENDIXES

Appendix A

ERRORS AND JUSTIFICATIONS - ALL ITEMS

	Life Char- acteristics	Use or Action	Movement	Locomotion	Spontaneous Movement	Logic	No Answer
Table							
Correct	25	8	19	9	4	21	6
Incorrect	1	2	1	0	0	0	0
Mountain							
Correct	26	3	20	5	0	20	15
Incorrect	1	2	0	0	0	2	2
Lamp							
Correct	19	10	14	4	4	16	13
Incorrect	0	11	2	0	0	3	0
Rain							
Correct	18	9	2	1	3	23	15
Incorrect	0	8	12	0	0	3	2
Bicycle							
Correct	20	5	0	2	29	12	9
Incorrect	0	14	4	0	0	1	0
Fire							
Correct	19	12	4	2	9	8	16
Incorrect	3	16	5	0	0	1	1
Pencil							
Correct	17	13	8	1	19	11	10
Incorrect	0	9	4	0	1	3	0

Appendix A

Continued

	Life Char- acteristics	Use or Action	Movement	Locomotion	Spontaneous Movement	Logic	No Answer
Watch							
Correct	21	13	5	2	4	16	13
Incorrect	0	13	7	0	1	0	1
Bell							
Correct	20	10	6	1	18	15	11
Incorrect	2	9	3	0	0	0	1
Wind							
Correct	25	10	0	0	2	15	12
Incorrect	0	16	11	0	1	2	2
Airplane							
Correct	22	4	0	6	12	21	6
Incorrect	0	6	7	10	0	1	1
Sun							
Correct	22	4	7	0	3	15	8
Incorrect	2	21	6	0	0	6	2
Automobile							
Correct	24	3	0	2	9	19	13
Incorrect	0	9	9	0	1	6	1
Cloud							
Correct	25	6	6	2	4	14	14
Incorrect	1	6	14	0	0	4	0

Appendix B

CODING INSTRUCTIONS FOR THE CAUSAL EXPLANATIONS

You are being asked to categorize the responses of several children to questions about some mechanical demonstrations which were performed in their presence. The categories themselves were first described by Piaget. Your task will not be an easy one because the questionning was adapted to the children's responses and, therefore, there is variation in both question and responses for each explanation. However, the first question asked of each child concerning a particular demonstration was the same for all children. In some cases, where one part of the explanation seems to call for one category and another part for some category, you will find one part of the response underlined. Base your rating of that response most heavily upon the underline section.

Below you will find a description of each of the demonstrations and the first question asked about each one. Following this, there will be descriptions and examples for each of the categories. Please familiarize yourself with the entire category schema before you begin to evaluate the explanations. Ask questions before you begin, and after you are completely finished, but not during the time you are categorizing. Try to

fit each of the responses into one of the categories given, but if this is impossible for any response, then indicate this by putting a question mark in the scoring column for that subject on that item. If the child says that he doesn't know, write DK in the scoring column.

(There followed the description of the demonstrations which appears in Chapter II.)

In questioning young children about causality and causal relationships, Piaget discovered that they do not give causal explanations in the same way that the adult does. He termed this childish form of explanation Precausality. He describes nine different forms that precausal thinking may take. As a group they are characterized by (1) a lack of knowledge about, interest in, and attention to the details of how events occur, (2) a lack of knowledge that spatial contact and energy transfer must take place before objects move, and (3) a lack of understanding of the temporal sequencing of events. Below are listed the precausal thought forms which he delineated, along with examples of each of them which may occur to one or more of the demonstrations. Mechanical and Logical Explanations are also described.

1) Psychological Causality. Explanation given simply in terms of the motives of the person who initiates the event. When the child simply refers to some action or intent of the experimenter, without attempting to relate this by further explanation to the demonstration, then he is giving psychological explanations.

(Why did the ball come back up? "You hit it?")

2) Finalism. When the child explains the event by referring to its end result, without elaboration of how this came about. Any response which states or implies that something happened "so that", or "in order that" the end result would happen, falls into this category. (Why does the ball come back up? "So you can catch it.")

3) Phenomenism. Here the cause for an event is taken to be something which is present concomitantly in the situation with the event, but which has no direct causal connection with it. The child seldom even attempts to indicate how the cause and the effect are related spatially or temporally. (Why does the water go up in the tube? "Because it is blue." Why does the penny stay in the box? "Because the string holds it.")

4) Participation. This explanation consists in indicating that the cause of an event is something which acts at a distance from the event. What is said to be the cause of the event comes from a distance away from the event (the wind that blows the balloon comes from outside the window) or it is assumed that the cause which is located in one place acts at a distance to produce the effect. (What makes the cork pop? "The fire does"-- with no

further explanation of how the fire at the bottom of the tube makes the cork pop at the top.)

5) Magical Causality. An explanation which indicates that some gesture of the experimenter was efficacious in producing the effect, with no indication of spatial contact or transfer of energy. (How did the ball get back in the cup? "You rubbed it and that made it come back.") (Simply answering, "Magic" to this question is not taken to be an explanation of this category. Children were always pressed to explain what they meant by magic).

6) Moral Causality. The event is explained by stating or implying that it had to happen or should have happened or was supposed to have happened. The implication is that there is some kind of moral necessity or constraint acting upon the event. (Why does the propellor turn? "Because it's supposed to".)

7) Artificialistic Causality. Explaining an event by saying that it was made by God or man so that it would happen in the way it did. (Why does the ball come back up? "People make them to bounce.")

8) Animistic Causality. An inanimate object is seen as alive and/or conscious. Any response which implies that the object knew what was happening or wished it to happen. (Why did the cork do that? "Because it wanted to.")

9) Dynamic Causality. Here the explanation is by reference to the strength, force, hardness, lightness, or other energy-like quality with the object that is said to explain the event--without any attempt to explain how this works. It is simply that

the objects possess enough energy to account for the even. (Why does the ball come back up? "The floor makes it." Why does the penny stay in the box? "The box is stronger than the penny." Why does the block stay in the same place? "Because it's heavier than the card.")

10) Mechanical Causality. These responses are characterized by the properties lacking in the precausal forms. There is an indication of spatial contact, transfer of energy, and temporal sequence. That is not to say that all of the explanations of this type are correct, or even completely adequate, but rather that they indicate that the child has come to use the same rules of causality as the adult--looking for the details of how the event occurs. (Why does the water come up in the tube? First you squeeze it, and the water goes out of the tube and when you let go, it can come back up in the tube." Why does the balloon do that? "You blow it up and it's not tied and when you let it go the air come out and the balloon flies around." Why does the penny stay in the box? "It turns over so fast, that by the time the penny starts to fall, the box is underneath it again.")

11) Logical Explanations. This is a slightly different order of explanation that will be seen occasionally. It is logical in form and thus says, "That is an X, and all X's do that," or "All X's do that and that is an X". (Why does the ball come back up? "It's a rubber ball and rubber bounces.")

Appendix C

EXAMPLES OF CHILDREN'S EXPLANATIONS

Demonstration One: The Balloon

"What makes the balloon do that?"

#24 When you blow it up. (What makes it do that?) DK (Why does it do that DK Psychological

#8 Wind. (How does the wind make it do that?) It got in the window, that makes it go. Participation

#20 Cause it's air that makes it do it. (How does the air make it do that?) When you turn it loose it flies and makes that noise. (How does air make it fly?) The air is strong and makes it do that cause it can't do that itself.

Dynamic

#16 The hole make it do that. (How) DK. Phenomenism

#41 You blew it up and there's lots of wind in it and when you let go of it, the air goes out of it and pushes it around. (How does the wind do that?) When the air goes out that way it makes the balloon go the opposite way. Mechanical

#54 The wind. (What wind) The air. (How does the air do that?) The wind that comes out of your mouth and blows the balloon up and it flies away. Dynamic, Participation, Mechanical.

Demonstration Two: The cork in the test tube
 "Why does the cork do that?"

#6 The fire. (How does the fire do that?) It burns, it burns up. (How does the fire make it pop?) It burns up and the cork flies. Participation

#19 The light. (How did the light do that?) The light popped up and it popped that thing. (How). DK. Participation

#22 The cork pops. (What makes it do that?) It pops. (What makes it pop like that?) You made it go and it pops.

Psychological

#50 Cause the fire makes it go up. (What does the fire do that makes it go up). By that stuff, that black on the outside (carbon on the test-tube). That black stuff made it pop.

Phenomenism

#38 When it's heated, the pressure pushes against the cork and makes it fly out. (What pressure?) The pressure's the air. When things get heated, they build up steam or gas and there gets to be so much gas that it pops out.

Mechanical

#46 Because when that thing light, it blows hot air in there and makes it pop off. (What air?) Comes from the candle and goes up that glass. (How does the air make it pop?) It goes through that glass. Dynamic, Participation, Dynamic.

Demonstration Three: The block on the card
 "Why does the block stay in the same place?"

- #1 You made it. (How?, Why?, etc.?) DK Psychological
- #7 Cause the block is stronger than the card. Dynamic
- #69 When you hit it, the block stays down cause the card ain't heavy enough and the block is. Dynamic
- #93 The card's slippery. When you push it real hard, it goes fast, it takes the block a while to get going. Because the card is slippery. Mechanical
- #94 Because the card moves so fast that the block didn't have time to stay on. The block wasn't moving as fast as the card. It didn't have time to stay on. Mechanical
- #28 Cause it's supposed to stay over there. (Why does it stay over there?) Because it's supposed to. Moral
- #29 Cause it wants to. Animism
- #22 Because it stays in the same place. When it stays in the same place you put the card there. (Why does it stay in the same place?) Because it does. Finalism, Non-mech.

Demonstration Four: The penny in the box.

"What keeps the penny in the box?"

- #4 You swung it around. (How did that keep it in?) You were holding it tight. Psychological
- #9 The string. (How) Cause you were moving it. (How does that keep it in?) The string was tied on it. Phenomenism
- #28 Cause it's supposed to stay in there. Moral
- #20 Because it wanted to and it stayed in there because it's stuck. (What keeps it in the box?) Because it wanted to stay in there. Animism
- #58 Because you're doing it so fast it doesn't have time to fall out. By the time it starts to fall, it's back down. If you did it real slow it would fall. Mechanical
- #38 The centripital force, the penny tries to get as far away from the center as possible, even when upside down it tries to go up. Mechanical
- #31 The box. (How does the box do it?) Cause it sucks, it holds the penny. Animism, Dynamic, Phenomenism.

Demonstration Five: The bulb in the water

"What makes the water go up inside the tube?"

- #10 You squeeze it up; you let your hand go like that. (How does that make it go up?) You push it up, let your finger go and then the water goes up. Psychological
- #32 There's a hole and the water goes up. (Why does the water go up?) The water splashes and gets up. (Why?) Cause it's got a little hole. Phenomenism
- #49 Cause the air blows it up. (Why does it do that?) To get it up there. (How does it do that?) With the air. Dynamic
- #7 Cause it makes the bubbles. (How does that make it go up?) They push it up. (Why?) DK Phenomenism
- #28 It's supposed to go in there - that's why the water's blue. Moral
- #96 When you squeeze this, air in the bulb forces the water out; when you let go of it, the air in the jar forces the water up and the bulb goes out. (Why does it do that?) The air in the jar pushes down on the water 25 pounds, and it pushes it up in the tube. Mechanical
- #91 Air inside the tube. (What does it do?) When you squeeze it, the air pushes the water down, when let go the air comes back up. (Why?) DK. Mechanical
- #29 Cause it wants to. Animism
- #35 Something up there at the top pulls it up. (What is it?) Something like air. (What does that something do?) It pulls it up. (How?) It pulls in, when you squeeze it, it pulls it up, the water in the jar. Dynamic, Phenomenism, Participation.

Demonstration Six: The ball bounced on the floor
 "Why does the ball come back up?"

#24 Because the floor makes it come back up. (How?) The floor
 make it bounce. Dynamic

#23 Cause you're bouncing it. (But, what makes it bounce?)
 DK. Psychological

#7 The floor does it. The floor is strong. Dynamic

#40 It's made to bounce. Artificialistic

#90 It's made out of rubber and rubber bounces. Logical

#78 It'll hit the ground with so much force that the ball gets
 a little flat, it springs into shape and that makes it go
 up. Mechanical

#85 When rubber gets hit against something it pushes back up.
 (Why?) Because it...clay will stay flat, a ball, instead
 of staying flat, because it's made of rubber, it tries so
 hard to get back to it's regular size, it bounces up.

Mechanical

#2 Because you put out your hand. (What does that do?) It
 goes down and comes back up. (Why?) It hits the ground
 so hard, it bounces...like me (he jumps down on the floor
 and springs up) It's like me when I'm jumping right.

Magic, Participation, Psychological.

Demonstration Seven: The ball in the cup
"How did the marble get back in the cup?"

#5 You rubbed it. (How did that make it come back?) DK

Magic

#8 It got through the table and in it. Participation

#13 Cause when you rub it, it just comes back. Magic

#22 You make it do that. (How?, Why?, etc.) No answer.

Psychological

#37 It disappeared and came back. Participation

#84 You must have had it in your hand and sneaked it back in there. Mechanical

#86 You had it in your hand all the time. (Why do you say that?) You couldn't just make it appear, it's just a trick. It's impossible. (How did it happen, then?) You couldn't do it with one marble, I think there are two. Mechanical

#69 It was in your pocket and by magic it came over and got in there. (How?) DK Participation, Magic, Dynamic.

Demonstration Eight: The propeller
 "Why does the propeller do that?"

#1 DK (What makes it do that?) You do. (How?) DK

Psychological

#31 The rubber band. (How?) That thing (points to motor)
 (What does that do?) Cause it goes around. (Why?) The
 rubber band make it (the motor) turn. Phenomenistic

#37 Because electricity is going up in the wire. It goes into
 that motor and turns that thing and turns the rubber band
 and it turns the propeller. Mechanical

#41 The motor inside there. (What turns the motor?) The elec-
 tricity goes from the wires into the motor. (What does it
 do then?) It makes the little thing turn, it turns the
 rubber band, which turns the stick, goes through the block
 and turns the propeller. (How does the electricity do
 that?) There's probably a little thing in there that elec-
 tricity hits and it starts to go.

#14 The rubber band. (How does that do it?) The thing on back
 of it. (What does that do). A machine. (What does that
 do?) DK. Phenomenism, Phenomenism, Participation.

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BIOGRAPHY

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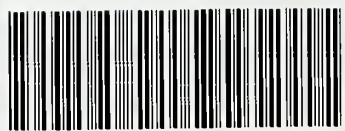


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